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AUTOMOTIVE

Report of the automotive industry human resources task force

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The Honourable Flora MacDonald, P.C., M.P.
Minister of Employment & Immigration
House of Commons
Ottawa, Ontario

Dear Madame Minister,

We, the co-chairmen of the Automotive Industries Human Resource Task Force, appointed by you on January 16, 1985, have the honour of submitting to you the following report.

Co-chairmen

Maurice C. Fertey
President
American Motors
(Canada) Inc.

Patrick J. Lavelle
President
Automotive Parts
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REPORT OF THE AUTOMOTIVE INDUSTRIES

HUMAN RESOURCE TASK FORCE

Table of Contents

ACKNOWLEDGEMENTS

The Task Force is indebted to a number of individuals and organizations who have made an invaluable contribution to the work of the Task Force since it was established in January, 1985.

The strength of this report is based on the extent to which it reflects a consensus among the industry, labour and government participants who contributed their time and resources to the study. Over 120 people responded with commitment and enthusiasm to the opportunity to contribute to our understanding of the human resource issues in Canada's automotive industry, and we are grateful for the effort devoted by all.

While it is not possible to identify by name all those who helped us in our work, we would like to identify certain individuals whose assistance was particularly important.

We gratefully acknowledge the important role of the Minister of Employment and Immigration, the Hon. Flora MacDonald, who provided the mandate and support which made this task force possible. We are also most grateful for the assistance provided by the Governments of Ontario and Quebec.

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Marty Anderson and John Paul MacDuffie to enhance our understanding of automotive industry trends globally.

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We express our utmost appreciation to all these individuals and the many others whose contributions have not been identified but which were nonetheless invaluable. The Task Force itself does, of course, bear full responsibility for the contents of our report and its conclusions.

REPORT OF THE AUTOMOTIVE INDUSTRIES HUMAN RESOURCE TASK FORCE

EXECUTIVE SUMMARY

Employment in the Canadian automotive industry today stands at record levels -- the workforce is over 120,000 strong. The industry has made a sharp turnaround since the recession of 1980-81, with parts and vehicle production and vehicle sales up significantly in the past two years. The industry has also improved its competitiveness; in addition to a labour cost advantage, Canadian plants are known for their above-average quality and productivity by North American standards.

This report is about how technological change and shifts in competitive pressures in the world automotive industry are affecting the Canadian automotive workforce and will continue to affect it over the next five to ten years.

> A central conclusion of the Task Force is that resolving the human resource issues facing the Canadian automotive industry will be crucial to the future of the industry. In particular, a major training effort will be essential for industry success.

The automotive world of the 1980s is much different from that of the immediate post-war period. One of the principal reasons, of course, is the entry of Japanese auto manufacturers into world markets. The Japanese automakers' success is due to a

combination of factors of both their own and others' making. They have been able to capitalize, for example, on favourable tax and export climates, relatively lower wage rates and the world energy crisis. But they have also met consumer demands in terms of the cost, quality and fuel efficiency of their products.

Despite their significance, Japanese cost and quality competition are by no means the only challenges facing North American automakers. Slower growth in automotive markets, continuing and new Japanese initiatives to respond to the changing environment, and the entry of new players (Korea, Brazil, Mexico) into the automotive world are all part of the far-reaching competitive pressures at work in the industry.

Implications For The Workforce

The North American auto industry has responded to international competitive pressures in a variety of ways. Each strategy has had implications for the workforce.

> To restore manufacturing competitiveness, vehicle manufacturers have been working to match Japanese innovations in production management and have accelerated their use of computerized automation.

The 'soft' technologies of production management -- statistical process control, just-in-time production, quick tool and die change -- are by definition about people; they have to do with the way people and equipment are organized in relation to each other and the tasks at hand. They place a premium on the intellectual and human skills required for teamwork and for assuming responsibility for more than just a single isolated operation in the production process. Job content is therefore one implication for the workforce, but job displacement is another, because of the higher operating efficiencies associated with better methods of organizing production. Parts plant workforces could also be disrupted as manufacturers moving to just-in-time production require their suppliers to relocate closer to assembly facilities.

The human resources implications of 'hard' technologies -- programmable controllers, robots, computer-assisted design and derivative technologies, advanced communication technologies -- are far from straightforward. Some jobs will demand more skills as a result of them, others will see skills requirements decline. The demand for some kinds of workers will rise while other job categories shrink. Machines may be able to reduce the need for people to perform boring or unpleasant jobs, but they could also have negative effects on the jobs remaining.

A second strategy of the North American vehicle manufacturers has been to source small cars offshore.

The Big Four automakers are using joint ventures with Japanese manufactures and other foreign firms to supply consumer demands and narrow the competitive manufacturing gap. The implications for the North American workforce of this growing practice are clear.

Efforts to restructure the parts sourcing system represent a third strategy of the vehicle assemblers.

The automakers are sourcing more components from outside suppliers in North America and abroad, using fewer suppliers and more sole-sourcing, and working with suppliers on product development. This means that competitive pressures in the parts sector are every bit as sharp as in the assembly facilities, and changes in skills requirements every bit as significant for the workforce. Loss or relocation of employment will be another result.

Automakers are improving product technology to create a technological image equal to that of the best European manufacturers.

For the workforces of both the assemblers and the parts suppliers, this means acquiring the skills and flexibility to respond to product innovations as rapidly as they are occurring.

Finally, recognizing that the workforce is a vital part of their response to the challenge of the new automotive world, the vehicle companies are experimenting with innovative approaches to management/labour relations.

Efforts to alter the organization of work and the respective responsibilities of workers and management, encourage more worker involvement, and increase job flexibility while reducing the number of job classifications have the potential to improve output and quality and create a better climate for labour-management relations. In the highly competitive automotive environment, however, there is also the potential for increased tensions.

Although there are notable examples in the Canadian automotive industry of highly innovative experiments with new forms of work organization and divisions of responsibilities between labour and management, for the most part the process has been evolutionary. Changes are being dealt with through the collective bargaining process and ongoing union-management consultation.

These trends in workforce management are in their infancy, with more time and experience with them needed to evaluate their future in the industry. The relative health and successful performance of the industry in recent years reinforce the value of proceeding carefully, so as to ensure that efforts to improve corporate performance also address the priorities of workers. Without any doubt, however, the industry is in the middle of a dynamic period of fundamental change, with the need for change recognized.

Rising Skills Requirements

Other trends are well upon the industry. In particular, rising skills requirements, as well as the training that implies, present an immediate challenge.

The Task Force found that although skills are declining in some areas, skills requirements in the industry generally are rising. Workers and managers are being required to

- master more skills than ever before, including skills not required of them in the past,
- use these skills more frequently in the course of their daily work, and to
- adapt these skills more often to changing situations.

Rising skills requirements have two kinds of implications. To hold their own with the hard and soft technologies described earlier, individual autoworkers need a better grasp of basic skills (reading and writing, manual dexterity, employment skills), analytical skills, interpersonal skills, and technical skills -- be they specific to a trade, a process or a piece of equipment.

Second, changing aggregate skills requirements are shifting the mix of occupations in the industry workforce as a whole in two ways. The number of people in more highly skilled occupations is increasing gradually relative to the number in the less skilled occupations, and responsibilities within certain occupations, especially the skilled trades, are shifting -- generally in the direction of broadening job content.

New Training Needs

The automotive industry has already recognized that training its workforce will be a critical part of maintaining a competitive position in the new automotive environment.

The Task Force estimates that the training the industry needs to remain competitive will require massive efforts on the part of the industry, as well as significant commitments on the part of governments and educational institutions.

Total training costs in the industry in 1984 were about $75 million. They are likely to rise 2½ times -- to $200 million a year in constant dollars -- by 1990 if employment levels remain high.

Training needs range from basic skills (for example, 71% of companies responding to a Task Force survey of the independent automotive parts industry were satisfied with the reading and writing skills of their workforces, however 29% said that these skills were often inadequate) to training in the most sophisticated of the hard and soft technologies (again using the independent parts industry example, more than half the companies surveyed expected that 80% or more of their production workers would be using statistical process control by 1990).

Training for automotive workers will benefit other industries as well because there is substantial mobility into and out of the industry. The auto industry has been a major training ground for new workers in the economy as well as a source of skills for workers going to other manufacturing jobs.

The Role
Of Governments

The Task Force estimates that federal and provincial training assistance to the automotive industry in 1984 amounted to roughly $4 million -- only 5% of total estimated industry training costs of $75 million.

Automotive companies are anxious to have the government take a bigger role in funding training. But, given the expected rise in training costs by 1990, government training assistance will need to increase substantially just to keep pace with industry expenditures. As a result, it will be more important than ever that training programs be designed in a way that is suited to the needs and structure of the automotive industry -- which is often not the case at present.

Educational institutions should also be responding to the industry's training needs. The automotive industry needs workers fresh out of school to have higher basic literacy and mathematical skills, and post-secondary institutions should devote more effort to keeping current on the industry's needs and to delivering training where more manufacturers and workers want and need it. Governments, educational institutions and the industry could also explore the potential for sharing the cost of course development as a means of reducing overall training costs.

Future Shape Of The Industry

How will these trends in the automotive world affect the workforce in the Canadian industry? To project future employment levels, occupational profiles and skills requirements, the Task Force identified three illustrative scenarios for the future size of the industry. Under the first scenario, which the Task Force calls "Universal Auto Pact", the Canadian industry (as measured by the amount of net shipments) could see growth of 45% in the next five years. At the other extreme, the "Import Flood" scenario could result in a 23% real decline in Canadian industry shipments. The middle ground scenario, labelled "More of the Same", might produce a 15% increase in overall shipments by 1990.

In terms of jobs, this might translate into a 13.5% rise in employment under the first scenario, a 31% decline under the Import Flood scenario, and a 10% decline under the middle scenario. It is clear, then, that some labour dislocation in the auto industry

is inevitable by 1990. Even under the most optimistic scenario, some jobs losses are likely, but in an expanding automotive employment market, most of these workers would be re-employed relatively quickly.

Where the actual performance of the industry between now and 1990 will fit into this range of possibilities will depend in large part on the response of Canadians in four critical areas:

1. The government of Canada must adopt a trade policy that will result in higher investment from offshore and significant purchases of Canadian-made parts.

2. The Canadian operations of the North American vehicle companies will have to strive for continuing gains in improving productivity and quality.

3. The Canadian independent parts industry will need to continue its aggressive approach to expansion, including selling to the new Japanese plants in Canada and the United States and gaining a substantial share of Big Four outsourcing contracts.

4. Labour and management in Canada will need to develop a human resource strategy that takes the best of the new models of work organization and tailors them to the Canadian environment. Governments and educational institutions will have to back up this strategy with appropriately structured and funded support for industrial training programs.

The North American automakers recognize the importance of human resource management and understand that the hourly worker on the production line is an untapped source of future productivity and quality gains. North American autoworkers and their skills will be a central part of the competitive battle, and the companies which know how to train and manage the workforce and which support these skills with investment in new equipment, process and design technologies will be the survivors. Governments can support that effort by increasing their commitment to industrial training.

Despite the high level of foreign ownership, it is clear that the future of the automotive industry in Canada depends on the decisions and actions of Canadians. Trade policy, competitiveness and human resource management are all requirements which must be addressed in Canada. Canadians created a vigorous and healthy automotive sector. It will be up to Canadians to sustain it.

CHAPTER 1

THE NEW AUTOMOTIVE WORLD

The last ten years in the world automotive industry have witnessed a competitive realignment more far-reaching than any since the rebuilding of the European industry in the postwar period. At the heart of this realignment has been the emergence of the Japanese auto industry as a competitive giant of proportions equal to those of the North American and European industries. The Japanese success has been due to a combination of factors of their own and others' making. Relatively lower wage rates, a favourable tax and export climate, and Japanese manufacturing innovations have combined to give them a strong competitive position in terms of both product cost and quality. But it was OPEC and the second oil price shock of 1979-80 that fortuitously handed the Japanese an opportunity to boost exports to North America, a market that previously had favoured large cars, which the Japanese did not produce.

The rest of the story is well known to Canadians. Japanese car imports surged to 25% of the Canadian market and 22% of the U.S. market by 1982 (see Table 1.2). This import attack coincided exactly with deep recession in the North American vehicle market; total vehicle sales fell by 34% from their 1978 peak. The combination of high Japanese import levels and declining sales caused massive financial losses, plant closures, and widespread layoffs to the industry in both Canada and the United States.

In response, the Canadian and U.S. governments each negotiated voluntary restraint agreements with the Japanese to hold imports at tolerable levels and give the North American industry time to respond. The economic recovery of 1983-84 brought sales back and with them profits. Employment in Canada has responded in kind, rising back to peak levels of over 120,000.

The U.S. has now dropped its formal restraint agreement with Japan while Canada continues with an informal restraint agreement at a higher import level than before. The Japanese vehicle companies have moved quickly to increase their exports to the U.S., and have announced intentions for substantial investments in North American assembly facilities posing a threat to existing U.S. and Canadian vehicle production. There is now considerable uncertainty as to whether prosperity has truly returned to the industry or whether the current recovery is merely a respite in the inevitable restructuring of an old manufacturing sector.

In this chapter we present an overview of the new automotive world that has emerged over the past decade and the broad outlines of how the global industry will change during the next ten years. In the following chapter we assess the implications of those changes for the Canadian automotive industry and try to estimate the possible future size and scope of the industry in our country. Of course, the future shape of the Canadian industry will depend on decisions made on matters of trade policy, investment and labour relations. Consequently, we project not one future for the industry but a range of futures depending on those decisions as well as on actions that will be beyond our nation's control.

These first two chapters set the stage for the human resource issues our Task Force was asked to explore. However, they serve as much more than mere backdrop. They also delineate the observations and assumptions upon which our conclusions about human resources in the industry are based. As we shall see, a thorough understanding of the new automotive world and its implications for Canada lends urgency to the need to address the human resource issues in the industry, because their resolution lies at the heart of future industry success.

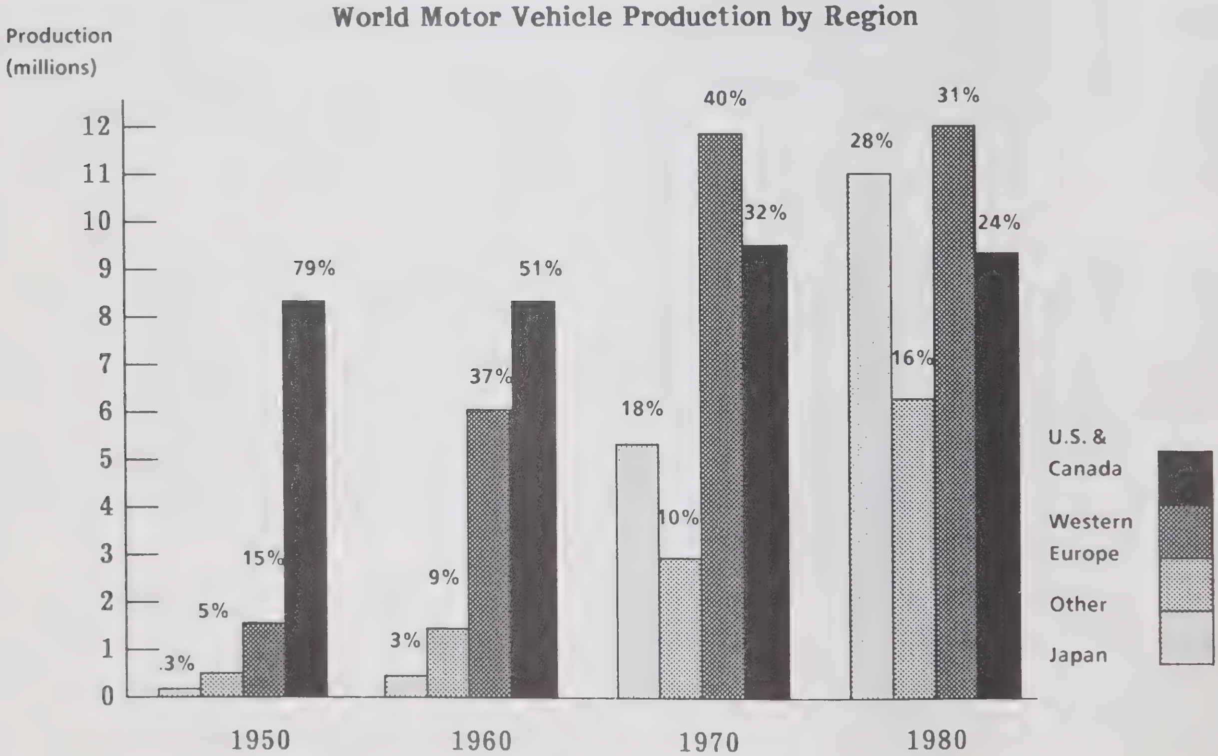
THE POSTWAR TRANSATLANTIC BALANCE

The new automotive world began with the postwar development of a European industry equal in stature to the manufacturing giant already existent in Canada and the United States. Until the 1950s the world automotive industry was dominated by North

American producers. Even during the two decades before World War II, when European governments were using high tariff walls and other protectionist devices to foster a European industry, the bulk of world production developed in Canada and the U.S. In 1950 North America accounted for 79% of all world motor vehicle[1] production (see Figure 1.1). In part this reflected the earlier development of a consumer mass market in Canada and the U.S., but equally important were major innovations in assembly line production by Henry Ford and others, which greatly reduced costs and made possible lower prices, thus stimulating demand. The European industry, which scattered production in many smaller national markets to overcome tariff barriers, never gained the same economies of scale, despite the fact that Ford and General Motors invested in Europe and spread their manufacturing knowhow.

Figure 1.1

World Motor Vehicle Production by Region



Source: U.S. Motor Vehicle Manufacturers Association

1. Throughout the report "vehicles" refers to all vehicles including cars, trucks, and buses

In the 1950s the European industry began to expand as tariff barriers fell in the long movement towards a common market. The variety of tastes in the European market occasioned a much wider diversity in European products than was found in North America. Previously, this diversity had worked against economies of scale. But with the advent of lower tariffs, a highly differentiated product could often find enough buyers in several countries to make longer production runs viable. European diversity thus became a strength that eventually enabled European firms to export to North America special niche vehicles like the Volkswagen Beetle and German high-performance cars. Thus, in the 1960s and early '70s, the North American and European industries were in a state of rough balance, with few trade barriers, some exports each way (although mainly from Europe to North America), a degree of cross investment (although mainly by U.S. firms in Europe), and roughly equal levels of production. This balance proved fleeting, however. Across the world, in relative isolation, the Japanese had been building their own motor vehicle industry.

THE JAPANESE CHALLENGE

The Japanese ascendancy that ultimately upset the transatlantic balance did not occur overnight. The Japanese industry began its modern development after World War II from a much lower base than the European industry. In an effort to create an indigenous industry, the Japanese government forbade foreign ownership of auto plants, locked out most vehicle imports, and arranged low-cost credit and preferential tax treatment for the industry. In the 1950s and '60s the early Japanese producers struggled to create modern efficient production systems. They borrowed heavily in design and production technology from North America and, to a lesser extent, Europe. However, they eschewed foreign management models and created unique organizational structures, labour relations systems and work methods.

To start with, each of the major Japanese vehicle firms evolved as part of a larger industrial group of firms tied to at least one bank and a "zaibatsu" or trading house. This allowed the emerging vehicle companies to draw on strong bases of financial and export expertise. The largest vehicle makers were also closely tied to their major parts

producers, owning stakes in many of them and openly sharing technology and management expertise. Many components were "sole-sourced" from a single supplier, requiring not only a high degree of manufacturing integration but also stable long-term relationships and shared management information and planning.

The Japanese approach to human resources management was even more unusual. Each company developed its own union, which usually identified quite closely with the interests of management. Lifetime employment guarantees were extended to workers in the major companies, although these were made possible in part by the buffer provided by the fragmented cottage segment of the parts industry, which employed about 10% of all motor vehicle workers and offered no employment assurances. Employment guarantees, combined with the Japanese cultural emphasis on respect for authority, created a strong sense of employee loyalty in the workforce and made for generally smooth labour relations.

Cooperative labour relations in turn laid the groundwork for a different approach to work organization; companies sought the participation and contribution of individual hourly workers in solving production problems. Initially obtained through "quality circles", this participation has come to be a hallmark of the Japanese automotive production system and has enabled the development of their two most important manufacturing innovations: "total quality control" based on statistical techniques and "just-in-time" production. These two innovations depended on heightened worker involvement in production decision-making and indeed grew out of joint worker and management attention to the limitations of current production techniques. In both cases the Japanese industry radically changed traditional management practice.

With regard to quality, the Japanese manufacturers rejected the notion that quality control consisted mainly of inspecting for and repairing defects. They sought total quality control and the prevention of defects through control of the production process. (We describe the main technological tool in these efforts, statistical process control, in Chapter 3.) Traditional auto industry management viewed increased quality as inevitably bringing higher production costs. Japanese firms were able to demonstrate that if higher quality came from eliminating production problems, its pursuit could result in lower manufacturing costs. A defect prevention approach to quality has the

power to increase productivity by reducing scrap, identifying and removing manufacturing bottlenecks, minimizing production downtime, reducing inventories and cutting warranty costs.

Just-in-time production was a manufacturing innovation almost equal in power to total quality control. Traditional management wisdom decreed that sufficient buffer inventory should be maintained between each step in the production process to prevent the whole system from stopping if any particular part of it went down. The Japanese developed a radically different approach based on the gradual removal of all buffer inventory in order to highlight production problems and bottlenecks, which could then be corrected. Eventually, the approach became a management philosophy to eliminate waste and balance the entire production process to the demands of the market. In the most advanced Japanese firms it has resulted in dramatically lower economies of scale, unprecedented flexibility in production, and lower costs.

As with statistical process control, just-in-time requires a high degree of worker involvement in the production process to identify and solve problems as they occur. In both cases the role of the hourly worker is far broader than in traditional North American and European plants. These radical innovations in production and human resource management resulted in steadily increasing productivity and quality. Taken as a whole, the Japanese production system represented a breakthrough in manufacturing technology as profound as the original assembly line in its day. We describe these new production systems and their implications for Canadian workers and firms in later chapters. We believe they represent technological changes as far-reaching in their potential as robotics and computerized manufacturing.

Of course, these manufacturing systems were not developed overnight. They evolved slowly over the 1960s and '70s, and individual Japanese firms made differing contributions to them. But regardless of where innovation occurred it spread quickly to other Japanese companies. For the most part these innovations were unnoticed outside Japan. This was due in part to the poor results Japanese firms experienced in their first attempts to export vehicles in the 1960s. By the early 1970s the results of improved Japanese quality and productivity began to pay off as Japanese exports captured small

but slowly growing positions in the North American and European markets. The stage was set for the Japanese to establish themselves as a major presence in those markets.

The fuel price hikes and fuel shortages of the '70s, provided the opportunity. Suddenly, North American consumers were demanding the smaller fuel-efficient cars that were the heart of the Japanese product line. This market shift coincided perfectly with the Japanese industry's attainment of world leadership in manufacturing techniques. Their market share rose sharply, to over 20% in North America and nearly 10% in Europe. As the North American manufacturers retooled for small car production, however, it soon became apparent that the Japanese success was based on more than just the market shift to small cars.

Cost and quality comparisons were undertaken by the major companies and by independent researchers; all confirmed that the Japanese had developed a major cost advantage over North American manufacturers in the production of small cars. Japan had also established a reputation for the quality of their small cars. The 1983 Federal Task Force on the Canadian Motor Vehicle and Automotive Parts Industries reviewed these U.S. studies and concluded that after adjusting for exchange rates and Canadian labour costs, which are about 70% of U.S. labour costs, the Japanese vehicle companies at that time had a landed cost advantage in Canada before duty of between C$1,500 and C$2,100 per small car over domestic vehicle manufacturers.

Some of this cost advantage was due to higher Japanese productivity . At least half, however, was due to other factors, such as lower Japanese wage rates, lower corporate and employee taxes, the under-valued Japanese Yen, and, in some cases, lower materials costs.

The labour cost difference in particular has been significant. Japanese labour costs have ranged between 60% and 70% of Canadian labour costs in recent years. In 1984, for example, the average Japanese auto worker earned US$6.82 an hour -- 68% of the average Canadian auto worker's wage of US$10.02 an hour. On top of that the average Canadian worker had fringe benefit compensation equal to 30.1% of his hourly wage, while the typical Japanese worker had benefits that added only 17.8% to his

hourly wage. Thus, the total hourly labour cost of a Japanese auto worker was only 62% of that of a Canadian auto worker in 1984.

Table 1.1
1984 Hourly Compensation Costs for Production Workers in Motor Vehicle and Equipment Manufacturing
(All Figures are Provisional Estimates in US$)

Country	Average Hourly Wages	Additional Benefit Compensation As % of Hourly Earnings	Average Total Hourly Compensation Including Benefits	Comparative Index on Total Compensation Canada = 100
U.S.	$12.74	50.8%	$19.21	147
Canada	$10.02	30.1%	$13.04	100
West Germany	$6.37	91.7%	$12.21	94
Sweden	$5.75	66.9%	$9.60	74
France	$4.36	90.7%	$8.31	64
Japan*	$6.82	17.8%	$8.03	62
Brazil	$1.39	36.7%	$1.90	15
Korea	$1.46	16.0%	$1.69	13

* Includes motorcycle manufacturing
Source: Canada Consulting based on U.S. Bureau of Labour Statistics, August 1985

Wage differences and labour practices are playing an increasingly important role in the world automotive industry beyond Japan as more and more low-wage countries are developing production capabilities for automotive parts and vehicles. Brazil and Korea, for example, are now manufacturing vehicles for export to industrialized countries. In Brazil the average total hourly compensation for auto workers is 15% of the Canadian rate; in Korea it is only 13% of the Canadian rate. The Canadian industry is more productive than either the Brazilian or the Korean industry, but low wage costs will make them viable competitors as they master the basic technologies of car-making.

The Japanese export surge to North America may thus be only the beginning of continued export pressures from newly emerging automotive producers. In the case of Japan, producers have combined their lower labour costs with genuine innovations in manufacturing processes to produce a lower-cost small car. New producers in South America and Asia will be hoping to succeed mainly through lower labour rates. The North American and European industries are now restructuring to meet these competitive challenges. That restructuring has required both government and industry action.

REBALANCING THE WORLD INDUSTRY

Governments in Europe and North America were quick to respond to the Japanese challenge. In all automotive countries the industry is a key linkage sector employing thousands of people not only directly but in dozens of supplier industries from steel to computers. Moreover, high productivity, and the high wages made possible by high productivity, have always made the automotive industry an important contributor to living standards. Governments in Europe and North America were loathe to let Japan's recently acquired productivity advantage harm such a critical industry.

With over two million European automotive jobs on the line, governments in Europe acted in the late 1970s to limit Japanese vehicle imports. In 1975 Britain reached a negotiated agreement with Japan that held imports to the U.K. to 11% of the market. In 1977 France implemented a 3% limit on Japanese imports. Italy had historically held Japanese imports to 2,000 units a year under a mutual pact with Japan, so it was already well protected. In 1981, Germany, Belgium and the Netherlands all reached import restraint agreements with the Japanese, and by 1983 Sweden warned that sharply higher Japanese sales in that country would be met by formal action. By 1983 it was clear that Japan's 9% share of the European auto market could not be increased.

In Canada and the U.S. the response to the Japanese challenge took the form of voluntary restraint agreements (VRAs) with Japan. Beginning in April of 1981, VRAs

held Japan's total unit exports to pre-set limits. The agreements were renegotiated each year. In practice the Japanese car market share peaked at 25% in 1982 in Canada and dropped to 17.6% in 1984 as domestic sales recovered. In the U.S., the Japanese car market share peaked at 22.6% in 1982 and dropped to 18.3% by 1984.

Table 1.2

Passenger Car Sales and Import* Levels in the U.S. and Canada

1978-1985

	Canadian Market			U.S. Market		
	Total Sales	Japanese Share	Other Import Share	Total Sales	Japanese Share	Other Import Share
1978	989,000	11.4%	6.0%	11,314,000	12.0%	5.7%
1979	1,003,000	8.0%	5.9%	10,673,000	16.6%	5.3%
1980	932,000	14.8%	5.7%	8,979,000	21.2%	5.5%
1981	904,000	23.0%	5.5%	8,536,000	21.8%	5.5%
1982	714,000	25.0%	6.4%	7,981,000	22.6%	5.3%
1983	843,000	20.9%	4.9%	9,182,000	20.9%	5.1%
1984	971,000	17.6%	7.7%	10,391,000	18.3%	5.1%
1985 (11 months)	1,061,000	16.5%	12.5%	10,226,700	19.6%	5.6%

* Imports include only cars brought in outside the Auto Pact (see Chapter 2).
Source: Motor Vehicle Manufacturers' Association of Canada

In April 1985 the U.S. did not request any formal restraint agreement with the Japanese, although Japan unilaterally volunteered to hold exports to the U.S. this year to 2.3 million units -- 24% above last year's export level of 1.85 million cars. Canada and Japan recently negotiated a mutual understanding until March 31, 1986; exports to Canada can increase by 18,000 units but will be kept around 18% of the market. While not expressed in unit terms, the understanding seems similar to previous restraint agreements except that it sets no precise limit.

The goal of voluntary restraint agreements in Canada and the U.S. was to give domestic auto makers time to respond to the Japanese competitive challenge and, at the same time, to encourage Japanese vehicle and parts firms to locate production in North America. With regard to the first objective, the North American industry has responded vigourously. With regard to stimulating Japanese investment, the U.S. has been quite successful in securing Japanese plants; Canada has to date been somewhat less so.

Honda, Nissan and Toyota, through its joint venture with General Motors, will together produce some 350,000 vehicles in the U.S. this year. Based on announcements to December 1985, we estimate Japanese firms will be producing over 1.5 million vehicles in the U.S. by 1990 (see Table 1.3). This will include some 1.4 million units of automobile production, which could amount to between 15% and 20% of all U.S. car production in 1990 depending on cyclical factors. Other facility announcements could be forthcoming. No Japanese producers are currently making cars in Canada, but Honda and Toyota have announced small-scale plants whose output would total 130,000 units by 1990. A few other Japanese vehicle producers are known to be discussing Canadian assembly investments, although these would most likely be joint ventures with established manufacturers already located here.

Surprisingly, Hyundai, the Korean vehicle manufacturer that has had significant sales success since introducing its cars to Canada in 1984, has already announced its decision to build an assembly plant in Bromont, Quebec to produce 100,000 vehicles a year starting in 1988. It is ironic that Hyundai, which has only recently begun selling cars in Canada, has been quick to announce an assembly plant investment, while the Japanese companies, which have had 15% to 25% of the market since 1980, have been slow to do so. The Japanese firms have been much quicker to invest in the U.S. where they have more exported vehicles at risk and where the threat of protectionist measures against those exports has consequently loomed much larger.

Table 1.3

Anticipated Japanese/Korean Vehicle Production in the U.S. and Canada, 1985 and 1990

U.S. PRODUCTION

Automaker	1985 Volume	1990 Volume
Honda*	140,000 cars	330,000 cars
Nissan	110,000 trucks	120,000 trucks
	40,000 cars	120,000 cars
GM/Toyota (NUMMI)	60,000 cars	300,000 cars
Toyota	-	200,000 cars
Mazda**	-	240,000 cars
Diamond Star (Chrysler/Mitsubishi)	-	240,000 cars
Total U.S. Production	350,000 vehicles	1,550,000 vehicles

CANADIAN PRODUCTION

Automaker	1985 Volume	1990 Volume
Honda	-	80,000 cars
Toyota***	-	50,000 cars
Hyundai	-	100,000 cars
Total Canadian Production	0 vehicles	230,000 vehicles
TOTAL - CANADA/U.S.	350,000 vehicles	1,780,000 vehicles

* Honda will also be building automobile engines by 1986.

** Mazda is 25% owned by Ford.

*** Assuming one-shift operation.

Source: Canada Consulting Group estimates based on published sources as at December, 1985

With respect to parts production, the Japanese investment bias towards the U.S. has been even more significant. At least 65 Japanese parts manufacturers have built plants in the U.S. not only to supply the new Japanese vehicle assembly facilities but also to sell direct to North American assemblers[2]. Only a handful of Japanese firms have built parts facilities in Canada, with the Toyota wheel plant in B.C. being the only one of significant size. The proposed Honda and Toyota assembly plants should help attract greater levels of Japanese parts investment to Canada, although U.S. experience indicates Japanese assembly plants built here will not source more than 50% of their parts requirements domestically, and the Canadian amount could well be lower.

THE AUTOMAKERS RESPOND TO THE CHALLENGE

The North American vehicle companies have responded to the Japanese challenge with a five-fold strategy:

1. Restore Manufacturing Competitiveness Overcome the Japanese manufacturing advantage by matching their innovations in production management and leap-frogging them in computerized automation.

2. Source Small Cars Offshore Use joint ventures with Japanese and other foreign firms to close the competitive gap in small cars.

3. Restructure Parts Sourcing System Source more components from outside suppliers here and abroad, use fewer suppliers and more sole-sourcing, and work more closely with suppliers, for example, sharing product development efforts.

4. Improve Product Technology Use aggressive product innovation to create a technological image equal to the best European firms.

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2. Canada Consulting Group estimates based on published sources.

5. Forge a New Deal with Labour Work with the UAW to promote greater worker involvement, reduce the number of job classifications, improve job flexibility, and foster more cooperative labour relations.

Naturally, there are differences between GM, Ford, Chrysler and AMC/Renault with respect to how much emphasis each is putting on various aspects of the strategy. But in one form or another each of the four is trying to implement some variation of this approach.

Restoring Manufacturing Competitiveness

General Motors, for example, is attacking the manufacturing issue in several ways at once. In all divisions the company is revamping its management approach to improve productivity and quality, including the adoption of Japanese-developed systems like statistical process control and just-in-time production. At the same time, GM is accelerating its use of computerized manufacturing technologies such as robotics, programmable controllers, and CAD/CAM (all of which are explained in Chapter 3). In many plants these new technologies have been accompanied by a substantial effort to get greater worker involvement in quality control and production problem-solving. In some plants, like Pontiac Fiero and Buick City, these efforts have succeeded; at others they have failed. (We discuss the whole area of worker involvement in Chapter 4.)

GM also developed a joint venture with Toyota called New United Motors Manufacturing (NUMMI) to produce, under Toyota management, small Toyota-designed cars in Fremont, California, for sale under the Chevrolet nameplate. The joint venture is giving GM a firsthand look at Toyota production systems while giving Toyota increased market access and some experience manufacturing in the U.S.

In addition to these efforts to stimulate evolutionary changes in productivity and quality, GM is pursuing development of what it hopes will be a revolutionary production system called the Saturn project, to be based in Tennessee. Saturn represents an attempt to marry the best of the Japanese manufacturing systems with GM's latest

innovations in high technology automation. The goal is to match Japanese productivity levels by 1988. Saturn could eventually become a complex of parts plants and an assembly facility, fully integrated in a paperless just-in-time production system.

Saturn has been organized as an independent company and has negotiated a separate agreement with the UAW that incorporates many of the approaches developed to heighten worker involvement at other plants. These include employment security agreements, work team organization, few job classifications, and worker involvement in decision-making. The agreement exists only on paper at this point and has yet to be ratified by the workers who will staff the company. The Saturn project is still in its infancy, but GM has pinned most of its hopes for manufacturing a competitive small car in North America on its success.

Ford, Chrysler and AMC/Renault have been pursuing their own efforts to close the competitive gap with the Japanese producers. Ford has substantially reduced its overhead costs and in many plants has been achieving labour productivity gains of 5% or more annually. Overall, Ford's breakeven volume in North America has been reduced by 40% since 1980. Ford runs a statistical process control school for its suppliers and its own management. The tremendous emphasis Ford has put on quality control is showing results in buyer surveys which indicate quality is up significantly.

Chrysler's approach to productivity has been to combine sharp cuts in overhead costs with greater use of automation. Chrysler has made extensive use of advanced technology -- especially robots -- in its recent refurbishing of the Windsor, Ontario, and Sterling Heights, Michigan, assembly plants. Overall labour productivity at Chrysler has doubled since 1980, to 20 vehicles per employee per year.

AMC/Renault will also be introducing state-of-the-art automation at its new Brampton, Ontario, plant scheduled to come on stream in 1987. That plant may provide a chance to bring together the best of European (Renault), North American (AMC), and Japanese manufacturing techniques if AMC's negotiations with several Japanese manufacturers for a joint production venture bear fruit.

Sourcing
Small Cars
Offshore

All the vehicle companies are making moves to bring into North America substantial numbers of vehicles, at least 800,000 in total, from offshore suppliers to help meet the competition in the small-car market. GM will import up to 280,000 minis and sub-compacts a year from Suzuki and Isuzu, its Japanese affiliates. Another 170,000 small cars will be manufactured jointly with Korea's Daewoo and imported by GM. Ford is importing cars from West Germany and Mexico and has recently announced a joint venture with Mazda and Korea's KIA to build sub-compacts in Korea for export to the U.S. Ford Canada has also announced intentions to start importing in the fall of 1986 30,000 sub-compact units a year from the Taiwan-based Ford Lio Ho Motor Co., a joint venture between Ford Motor Co. and the Lio Ho Automobile Industrial Corporation. Chrysler has long imported small cars from Mitsubishi and is planning to triple its imports to 250,000 a year. As well, Chrysler is bringing in K cars from Mexico. AMC/Renault is negotiating to bring in Japanese cars and has long imported Renault vehicles. These North American imports of foreign cars could be a stopgap until the manufacturing cost differential narrows, or they could become a permanent feature of the industry. If past experience is any guide, imports will likely become a standard part of the North American manufacturers' product mix.

How many of these foreign-produced vehicles will be brought to Canada is an open question. Because those to be imported from Japan would fall under the voluntary restraint understanding with Canada, it will be difficult for many of them to come to Canada. They would have to displace units from Honda, Toyota, Nissan and the other major Japanese firms. However, no such restrictions apply to imports from Korea, Mexico, Taiwan or Europe.

Restructuring The Parts Sourcing System

The restructuring of the North American parts industry is even more substantial than in the vehicle industry. The vehicle companies have moved aggressively to enlist the support of their suppliers in the competitive battle. Specifically, the car companies are

- enforcing tough new quality standards (with statistical process control mandatory) and quickly dropping those suppliers that can't meet them;
- consolidating sharply the number of suppliers;
- encouraging sole-sourcing of components with preferred suppliers;
- inviting suppliers to get involved in product research and development and favouring those that do; and
- looking for opportunities to move non-competitive in-house parts production outside.

Combined with these developments is the influx of foreign parts producers from Japan, Europe, Mexico, Korea, Taiwan and other countries. In many cases these new competitors bring new technology, lower labour costs, or both. Foreign-made parts currently account for about 8% of the total parts consumed in the production of North American-made cars[3] but could easily double to 16% by 1990. The inroads made by offshore competitors have been almost as deep in the aftermarket for replacement parts as in the original equipment market. Japanese firms, in particular, have been pursuing

3. Based on Automotive Parts Manufacturers' Association of Canada analysis of North American parts import statistics and total North American vehicle assembler purchases of parts. In the popular press the U.S. parts import level is often given as 15% but this includes Canadian-made parts.

opportunities in the large and growing aftermarket for Japanese cars.

The parts industry is facing a major consolidation that in many areas is already under way. For lean, competitive parts firms able to meet the industry's new quality standards, there are major opportunities. For those that are unable to adapt, their demise is likely to be swift. As we show in Chapter 3, many Canadian parts firms have made the transition to the new industry standards, but others still have a long way to go.

Improving Product Technology

In the new competitive environment, product technology has taken on renewed significance. All the major auto makers are scrambling to apply the latest in drive-train, suspension, brake system and other technologies to curry favour with consumers, who are more performance-oriented than ever. Product technology is in a greater state of flux now than at any time since before World War II.

Postwar designs changed vehicle technology only gradually. The essential systems -- engine, transmission, suspension -- changed little in basic concept and only slowly in actual design. In part this was because of the substantial investment in machinery and tooling dedicated to large-volume production of those component systems. Radical design changes could be accommodated only at a significant cost. Moreover, consumers generally accepted new technology only slowly over time. The sharp move to front wheel drive in the last eight years has heralded a new era of rapid technological diffusion. New product innovations on high performance cars now spread more quickly across the product range, and individual manufacturers copy each other's technological ideas with little lag time. While these changes are happening the world over, the battle is particularly intense in North America where the industry is trying to match the most technologically advanced European and Japanese firms. The competition is taking place in most areas of vehicle technology, but particularly the following:

- Overall Design for Manufacture Increasing attention is being paid to designing vehicles for ease of manufacture and maintenance.

- Materials Weight reduction and the search for performance improvements are increasing the use of plastics, aluminum, ceramics, fiber composites, and new bonding technologies like super-strong epoxies.

- Electronics Microcomputers are being used extensively, both under the hood and on the dashboard.

- Control Systems Anti-skid brakes, anti-slip acceleration systems and many other new control features are made possible by marrying advanced electronics to new system designs.

- Body Design Weight reduction and better aerodynamics for fuel efficiency are major body design goals; computers have simplified achieving both.

To succeed in applying these new technologies, auto makers are spending vast amounts on research and development and are buying new skills in the form of whole companies. GM purchased Electronic Data Systems this year to assist it in linking its factories electronically and to help eventually in building the electronic ties between design and manufacturing. GM has also purchased interests in a number of small companies making everything from lasers to trip planning computers. GM, Ford and Chrysler all hope to benefit from expanded activity in the aerospace industry, which often leads the auto industry in the use of new materials and the introduction of new design technologies. Ford has long been a significant participant in this industry through its aerospace division. GM recently outbid Ford for the Hughes Aircraft Corporation, and Chrysler bought Gulfstream Aerospace in their efforts to develop major activities in the industry. In addition to purchasing skills, diversification is also providing auto makers with sources of revenue outside the automotive industry.

The technological revolution is being experienced at the supplier level as well as in the vehicle companies, with the most advanced parts firms experimenting with materials and designs that reduce manufacturing costs and improve reliability. Many

parts companies are looking to supply component systems rather than individual parts -- for example, whole cooling systems rather than just pumps or radiators. As the larger firms move in that direction, they will increasingly take technological leadership away from the vehicle companies in those areas.

Forging a New Deal with Labour

The final element in each of the auto makers' strategies is to forge a new relationship with the workforce. Each of the companies is pursuing some efforts to increase worker involvement in decision-making, to reduce the number of job classifications, to gain labour flexibility, and to reduce absenteeism. At a few plants, these efforts are coupled with truly innovative guarantees of employment security, work team organizational structures, and the elimination of many management perks and distinctions. At the heart of all the experiments is the belief that the company relationship with organized labour and with the workforce in general will be a critical factor in future competitive success. In Chapter 4 we describe these relationships in detail. As will be evident from that discussion, they are still at an early stage of development, and only a handful of plants are actually operating in ways that are sharply different from past practices.

The UAW in Canada and in the U.S. are painfully aware of the current vulnerability of North American auto jobs. Union leadership in each country has expressed a willingness to consider new models of work organization and labour relations particularly at "greenfield" sites. Naturally, there is great reluctance to give up labour rights and prerogatives won in earlier years without a quid pro quo. Generally, that compensation has taken the form of employment guarantees, involvement in decision-making processes, or the improvement of work conditions. As with the move to new management techniques, the transition to a more cooperative labour relations environment is fraught with difficulties. The role of the union, like the role of management, must change, and such changes are threatening to many on both sides of the table.

THE EUROPEAN RETRENCHMENT

The European auto industry, weakened by internal structural problems, has had an even more difficult time responding to the new competitive environment. Import quotas have helped stave off the immediate threat from Japanese producers, but the industry now faces a painful period of restructuring to re-establish its competitive health. This period is made all the more difficult by overcapacity in the European industry. At least 20% of current production capacity (over 2 million units) is unnecessary, even with no increase in Japanese imports. Rationalizing this capacity will be a painful process, because different companies and countries are in very different competitive positions.

All the major mass market producers -- Ford, GM, Fiat, Peugeot, Renault, Volkswagen and British Leyland -- are struggling to obtain a competitive advantage in the volume markets. Less than two percentage points separate the market shares of all these firms, save British Leyland. It seems unlikely that they can survive in their present forms. Renault and Peugeot in particular will have to undergo massive rationalizations. A French government commission recommended last year that the entire French automotive industry, including parts firms, needed to shed 70,000 of the total 230,000 jobs in the industry.

Ford, Fiat and British Leyland have already undergone major rationalization, as have their parts suppliers. Ford slashed its European workforce from 140,000 in 1979 to nearly 100,000 today. Fiat has cut its workforce by 25% over the last four years and has invested heavily in new production technology. British Leyland, after scaling back its operations dramatically, has turned to a joint venture with Honda for a much needed infusion of new product designs and production expertise. Their new jointly developed luxury sedan will be aimed not only at Europe but also at the American small-car luxury market.

All of the mass market firms feel threatened in their small-car segments by the Japanese. Most are investing heavily in R&D to gain a product performance edge, and all are trying to close the production cost gap with Japan by adopting the best of Japanese manufacturing techniques and investing heavily in automated production

technologies. Volkswagen, Renault and Fiat are all world leaders in flexible automation and hope to be able to use that leadership to reduce dramatically the labour content of their cars. They also hope to be able to sell the technology to other producers.

The special-niche-auto-makers are in a much stronger competitive position than the mass market producers. BMW, Daimler Benz, Volvo, Saab and Alfa Romeo have targeted specific niches at the upper end of the market and have achieved both European and export success. These producers account for the bulk of the European auto industry's $6 billion trade surplus with North America. Their products have a reputation for engineering excellence and in North America have found a market among the affluent young. These auto makers can look forward to continued success, although as the Japanese move into the upper part of the market, they are beginning to threaten the lower end of the luxury car segment. Some of the Japanese firms have plans to tap the best European design expertise. Toyota, for example, has bought an interest in Lotus, one of the leading European design firms.

SLOW GROWTH NARROWS OPTIONS

Compounding the adjustment difficulties experienced by all major world producers is the fact that market growth in each of the major automotive countries will be slow compared to the past. All major forecasters expect growth of only 1% to 2% annually in Europe, North America and Japan over the next 15 years. The automotive market in Third World developing countries should grow at a higher annual rate of between 3% and 5% to 1990 and at 6% to 8% beyond that, but because of their efforts to establish their own automotive industries, most of them will not represent major export opportunities.

Table 1.4
Growth in World Vehicle Demand to 2000
(Millions of Vehicle Sales)

	Vehicle Sales 1979	Vehicle Sales 1990	Annual Growth Rate 1979-1990	Vehicle Sales 2000	Annual Growth Rate 1990-2000
OECD Countries	32.0	38.2	1.6%	43.9	1.4%
Less Developed Countries	5.4	8.2	3.9%	16.2	7.0%
Centrally Planned Economies	4.0	4.8	1.7%	6.7	3.4%
Total for World	41.4	51.2	2.0%	66.8	2.7%

Source: MIT Future of the Automobile Study, 1984

This slow-growth scenario narrows the range of options open to North American and European producers in competing with Japanese auto makers. All producers will be fighting over a pie that is growing very slowly. Moreover, productivity gains are always much easier to come by when volume is expanding, and to the extent that productivity gains could eliminate jobs, layoffs are unnecessary if sales grow quickly enough.

The Japanese producers are also finding that slow growth is reducing their options. As they experience the maturation of their home market and the blocking of many foreign markets through protectionist moves, Japanese firms are looking for major export opportunities in young expanding markets. There are few such markets, and many of the developing country markets that are growing faster are also restricting imports to help foster their own fledgling auto industries. In the end slow growth reduces everyone's options for dealing with worldwide competitive restructuring.

THE NEW JAPANESE STRATEGIES

The Japanese car makers have now had to adjust their strategies in light of the world's response to their manufacturing success. Unable to grow much at home, and

increasingly unable to sell more cars abroad, the Japanese firms have had to reshape their strategies radically to find long-term growth opportunities. While each of the Japanese auto makers is different in its approach to the new automotive world, all share elements of a common strategy. That strategy has six components:

1. Expand exports in those countries with few restrictions -- mainly developing countries and smaller OECD countries.

2. Move up-market to higher-priced cars in countries where exports are restricted to gain higher sales value even if unit sales are held constant.

3. Sell more vehicles direct to foreign competitors for export under their names, e.g., GM's imports of Isuzu and Suzuki models.

4. Sell more parts and sub-assemblies to other automotive countries and sell design and process technology to developing countries.

5. Build auto plants abroad to overcome trade barriers but try to retain production of higher value added components. By 1990 Japanese firms will have 3 million units of foreign assembly capacity -- much of it in completely knocked down kits that require only simple assembly.

6. Form joint ventures with foreign firms to share production and design technology -- usually in exchange for market access for jointly manufactured products, e.g., Toyota/GM in California, Honda/British Leyland in the U.K., Mazda/Ford in Mexico, Taiwan and Michigan.

These new strategies are only just beginning to bear fruit. The move up-market has already happened to a large degree and in the main has been successful. Japanese producers are not likely to start building large cars, but they will continue to add state-of-the-art advances to their best models to capture the market for small luxury cars -- especially those with a sporty look.

The foreign investment part of the strategy is likely to accelerate soon. Japanese firms that have invested heavily abroad have found that such investments need not mean the end of their manufacturing advantage. Honda reports that quality at its Marysville, Ohio, assembly plant is as good as in Japan, and productivity is within 10 to 15% of Japanese standards. If the new Japanese plants being built in North America and Europe achieve similar levels, it should greatly encourage further Japanese investment.

Overall, the Japanese have accepted an era of slower growth. With an estimated 83% of all their auto exports[4] under some form of control last year, such realism seems essential. But Japanese producers will be cautious in expanding exports even as previously restricted markets open up. After the U.S. ended its voluntary restraint agreement this spring, the Japanese imposed their own ceiling of 24% of the U.S. market to appease protectionists in the U.S. Congress and prevent the reimposition of controls. The Japanese will be especially cautious in North America since it accounts for the majority of their current profits.

As the Japanese industry restrains exports, it is helping to solve the problem of rebalancing the world industry by investing in plants in North America and Europe. However these new plants put increased competitive pressure on individual domestic firms in those regions. Thus, even if a new regional balance in production is achieved, the shape of world vehicle manufacturing will have been changed forever by the rise of the Japanese industry.

DEVELOPING COUNTRIES: THE NEW PLAYERS

Even as the automotive world continues to restructure in response to the Japanese challenge, a new competitive threat is materializing on the horizon. Several

4. According to the Japanese Automobile Manufacturers' Association.

developing countries are in the process of building automotive industries in hopes of achieving export successes not unlike that of Japan. Korea and Brazil are perhaps the most notable examples, but Taiwan, Mexico, Yugoslavia and other countries have major aspirations as well. All these countries have labour costs significantly below Japanese levels, enabling them to attack the lowest-priced end of the market.

Brazil was the first developing country to succeed in establishing itself as an export base. By using the carrot of its potentially large market and the stick of export requirements, Brazil was able to entice several multinationals to manufacture locally for export. By 1981 total exports from Brazil had reached 135,000 units -- representing about 22% of production and a modest success. However, Brazilian productivity has not been as high as productivity in North America, Europe and Japan, thus negating some of its labour cost advantage. Future exports will depend mainly on how lucrative the domestic market is and whether the multinational producers find it attractive enough to make it worth their while to continue building for export.

Korea has followed a different development approach, encouraging indigenous vehicle producers in the country to grow and eventually expand into export markets. To this end Korea copied the Japanese pattern of banning all car imports and severely restricting foreign control in the industry. The results of this approach were slow to come, mainly because Korea's domestic market grew much less quickly than anticipated. In the last year, however, the country's ambitious plans finally look as though they might be achieved.

Hyundai, the leading assembler, began exporting its Pony models to Canada in 1984, delivering 25,123 units. Canadian sales in 1985 of the Pony and the new Stellar models will exceed 80,000 units and annualized sales of over 100,000 units during the third and fourth quarters will result in a Hyundai passenger car market share for 1985 of approximately 8%. Hyundai's sales have been aided undoubtedly by the VRA restrictions

on Japanese sales and the fact that Korean cars can come into Canada duty-free.[5] Hyundai has also announced that it will build a $300 million Canadian assembly plant to produce 100,000 vehicles a year starting in 1988. As well, Hyundai has teamed up with Mitsubishi Motors, which will help market Hyundai cars in the United States. Mitsubishi has also taken a small ownership stake in Hyundai and is assisting in the design of a new car targeted at the American market next year.

Daewoo, another Korean manufacturer, has formed a 50/50 joint venture with GM to manufacture a small car for sale in the U.S. by 1987. Ford, Mazda and KIA Industrial of Korea will jointly manufacture Japanese-designed sub-compacts in Korea for the U.S. market by 1987. And Chrysler and the Korean conglomerate, Samsung, will be making cars for export in the near future, too.

While Korea's automotive industry is more indigenous than Brazil's, its manufacturers are hoping to expand quickly by teaming up with major multinational vehicle companies. Increasingly, most producers will probably look to the multinational producers for design, production and marketing assistance. The governments of Mexico and Taiwan have gone the Brazilian route of encouraging (or forcing) foreign investment to build capability for export. For example, AMC/Renault, Ford, Chrysler, GM, Mazda, Nissan and Volkswagen all are building vehicles and engines in Mexico for export.

Aside from the direct threat posed by developing countries in the market for finished vehicles, there is a danger that increasing levels of parts production will move offshore. Typical of these new arrangements is a major contract GM signed with Daewoo for the production of starter motors and alternators. Production of some labour-intensive parts is already shifting to second-tier developing countries like Malaysia, Thailand and China.

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5. Under Canada's general preferential tariff structure with respect to developing country imports, automobiles and automotive parts have been allowed duty-free entry. However, effective with the May, 1985 federal budget automotive parts were removed from the list of eligible duty-free imports and automobiles will be removed effective January 1, 1987. At that time the tariff on automobile and most automotive parts imports from developing countries will be 6.0%.

The overall issue with regard to developing countries is whether they will develop export capabilities quickly enough to create a significant new source of instability in the world industry. Until Hyundai's success last year, many observers would have said that major developing country export successes were at least five years off. It now seems certain that at least a few developing countries will succeed in penetrating industrialized markets for finished vehicles and parts by the early 1990s. As they do so, they will put increasing pressure on the Japanese and other producers to move up-market to higher-value products.

The potential for another Japanese-style export surge is low. The LDC producers will meet some trade barriers and, in any case, will likely be dependent on the major multinationals for marketing. That should make for slower and more orderly growth in their exports to industrialized markets. Nonetheless, collectively developing country producers could take significant market share away from the established industrialized country producers even if, individually, no one producer emerges as a major world player.

THE STRATEGIC IMPORTANCE OF HUMAN RESOURCES

The transformations taking place in the world automotive industry are complex and at times contradictory. The predictions of a few years ago -- the convergence of design around a few world car concepts, worldwide consolidation of vehicle manufacturers, and a continuing shift to small cars -- have all proved wrong. There is more diversity in design than ever before (though standardization in components is increasing); there are more vehicle manufacturers competing in international markets than five years ago; and large cars have increased their market share as fuel prices have stabilized.

Despite the difficulty in predicting market and product trends, the competitive logic of the industry is clear. Product technology and manufacturing productivity and quality are driving the competitive battle. In manufacturing, attempts to gain a competitive advantage will centre on advanced automation and the adoption of new management systems, both of which are requiring far greater attention to human

resource management. The new computerized technologies are in most cases demanding new and expanded skills from the workforce. New management systems like statistical process control are requiring more general problem-solving skills from the workforce and more involvement in production decision-making. All these changes are raising dramatically the level of training required.

New models of worker relations are also being tried as means of involving workers more in production problem-solving and quality control. At some plants, job flexibility is increasing and traditional management hierarchies are being dismantled. All these changes are part of the search for competitiveness and reflect the industry's renewed understanding that the greatest underutilized resource in the auto business is the hourly worker on the production line.

The competitive restructuring under way in the world automotive industry will not leave the balance of world production unchanged. It will certainly mean thousands of new jobs for some workers and unemployment for others. But even more profound than the creation and destruction of jobs and capital will be the new legacy of human resource management as a strategic tool. Auto workers and their skills, once viewed mainly as a variable cost, will now be at the centre of the competitive battle, and those companies that know how to train workers and use their skills will be the survivors.

The implications of the new automotive world for the management of human resources are profound. In the remainder of this report we explore those implications. They include significant changes in the skills and training required of hourly workers and management. They will encompass major shifts in the nature of jobs and the ways in which workers and management interact. The challenge in Canada will be to fashion an appropriate national strategy for our human resources that can enhance our ability to succeed in the new automotive world. The vehicle and parts companies, the UAW, and governments at all levels have important contributions to make to that strategy. This report outlines what the respective roles of each participant could be. In the past, human resource issues in the automotive industry usually took a back seat to strategic considerations. In the future they will be either essential to our success or strongly implicated in our failure.

CHAPTER 2

THE IMPLICATIONS FOR CANADA'S AUTO INDUSTRY

The new automotive world poses both threats and opportunities for Canada's auto industry. Like U.S. and European producers, Canadian companies and workers have felt the chill wind of Japanese and developing country competition. They have responded strongly, raising productivity and quality levels significantly since the recession. Canadian production has rebounded in kind, growing by 122% in nominal dollars since 1980, from $14.7 billion in total output to an estimated $32.7 billion in total output in 1984. Even considered in constant 1984 dollars, the recovery has been dramatic, with output rising by $13.4 billion or 69% since 1980 levels (see Table 2.1). The industry is flush with the success of recovery but wary of the future. Lower labour costs relative to the U.S. and a Canadian reputation for quality production augur well for further auto investment in Canada, but sharply higher levels of Japanese and other imports to North America and a low level of offshore investment in Canada pose a long-term threat to the industry's current size and scope.

In this chapter we examine the implications for Canada of the world automotive trends discussed in Chapter 1. In particular we make an estimate of the possible future size of the Canadian industry. As will be clear, Canada has some choices in how it responds to the new competitive challenges. Those choices will have at least as much to do with the future shape of the industry as the external forces beyond our control.

THE CANADIAN AUTOMOTIVE RECOVERY

The Canadian automotive industry has made a sharp turnaround since the recession. Rapidly recovering vehicle sales in North America and import restraint by

Japanese producers combined to give the domestic industry an opportunity to capture expanded production of both vehicles and parts. Total Canadian vehicle production was up 48%, to 1,830,000 cars and trucks in 1984 from 1,235,600 vehicles in 1982 (see Table 2.1). Canadian parts shipments reached $10.2 billion in 1984 -- up 76% in real terms over 1982 production of $5.8 billion (constant 1984 $). Employment responded in kind, rising from 103,100 in 1982 to an estimated 123,900 in 1984. By any measure, the industry's recovery has been dramatic; it has certainly confounded those who were predicting its imminent demise just three years ago.

Table 2.1

Production and Employment in the Canadian Automotive Industry, 1978-1984

	Total Canadian Vehicle Production	Total Industry Shipments (Current $ Billions)	Total Industry Shipments (Constant 1984 $ Billions*)	Total Industry Employment
1978	1,818,500	15.6	24.6	123,300
1979	1,631,600	16.2	23.6	123,500
1980	1,374,300	14.7	19.3	107,000
1981	1,280,500	16.9	19.4	109,200
1982	1,235,600	18.4	19.7	103,100
1983	1,502,300	23.9**	24.4**	111,900**
1984	1,830,000	32.7 Est.	32.7 Est.	123,900 Est.
1985	1,900,000 Proj.	38.0 Proj.	39.0 Proj.	130,000 Proj.

* Deflated using Statistics Canada Gross Output Price Indices 1978-1983 for SIC 323 (Vehicle Manufacturers) and SIC 325 (Parts & Accessories) and Canada Consulting Group estimates for the same price indices in 1984 and 1985.

** In 1983 Statistics Canada expanded SIC 325 (Motor Vehicle Parts and Accessories) to include certain plastic component and other manufacturers. This reclassification would have added $439 million in shipments and 5,800 employees to SIC 325 in 1982. To allow statistical comparisons, we have estimated the 1983 numbers in the table using the old SIC 325 classification without these additional firms. (1984 Statistics Canada estimates are based on a random sample survey using the old SIC 325 definition.)

Source: Statistics Canada

The Auto Pact And
Canadian Competitiveness

Canada's auto industry is linked firmly to the U.S. market and production system through the 1965 Automotive Products Trade Agreement, commonly referred to as the Auto Pact. Allowing duty-free access in both directions, the Auto Pact made possible a rationalization of the inefficient low-scale industry that had grown up behind Canada's high tariff walls before 1965. With about 80% of all Canadian vehicle production now exported to the U.S. under the Pact, the Canadian industry's fortunes are closely tied to conditions in the U.S. market.

The Auto Pact encouraged rationalization of the industry but with certain safeguards to protect the level of production activity and employment in Canada. Companies under the Pact must produce roughly one vehicle in Canada for each one they sell. In separate letters to the Canadian government, the major vehicle companies participating in the Pact also agreed to safeguards that ensure that each of them maintains value-added in Canadian manufacturing and purchased Canadian parts equal to about 60% of the total value of their sales in Canada.[1] Average Canadian value-added in 1984 for all Auto Pact producers was in fact equal to 83% of their total cost of sales in Canada.

The high degree of CVA achieved in recent years reflects the improving competitiveness of the Canadian industry relative to the U.S. The vehicle companies have been investing in Canada far more extensively than what the Auto Pact requires. Growing Canadian competitiveness stems from several factors. Canadian hourly labour costs in the automotive industry remain about 70% of U.S. hourly labour costs because of the lower value of the Canadian dollar and the greater burden of health care and other indirect compensation costs borne by employers in the U.S. (see Table 1.1). This relative cost advantage exists both in the Big 4 assembly and captive parts plants and in the independent parts industry, although wages are generally lower in much of the independent parts industry.

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1. For a thorough discussion of the history and workings of the Auto Pact see Chapter 2 of the 1983 report of the Federal Task Force on the Canadian Motor Vehicle and Automotive Parts Industries.

In addition to a labour cost advantage, Canadian plants are known for their above-average quality and productivity. Internal comparisons at GM and Ford have shown most of their Canadian plants to be in the top half of all comparable North American plants in corporate quality audits. Canadian facilities of the major vehicle companies also register generally lower absenteeism than their American counterparts. Internal analyses at General Motors, Ford and Chrysler also indicate that overall labour productivity in their Canadian plants is generally equal to or greater than that of comparable plants in the U.S., is competitive with European plants, and is superior to the productivity levels achieved in countries like Mexico and Brazil.

Canada's auto industry is thus generally competitive with that of other industrialized countries except for Japan. Canada's competitive advantages vis-à-vis the U.S., combined with the duty-free access to the U.S. secured under the Auto Pact, are having the effect of spurring Canadian production relative to the U.S. By 1984 Canada had regained its 1978 volume of vehicle production, while the U.S. was still at 85% of its 1978 volume. Canadian parts production had rebounded even more dramatically by 1984 -- to 131% of its real 1978 volume. By contrast, the U.S. parts industry's regained 98% of its peak 1978 volume. Canadian automotive employment reflected these gains, reaching a new peak of 123,900 workers in 1984. U.S. automotive employment in 1984 averaged 1,089,100 -- still 8.5% below its 1978 peak.

Canada's higher level of production also manifested itself in a $5.9 billion automotive trade surplus with the U.S. in 1984. This surplus consisted of a vehicle trade surplus of $11 billion and a parts trade deficit of $5 billion. The 1984 surplus represented the third straight year that Canada has had an automotive trade surplus with the U.S. after ten consecutive years of trade deficits.[2]

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2. In the nineteen years of the Auto Pact, the vehicle trade account has always been in surplus and the parts trade account in deficit, with the relative sizes of each determining whether the overall automotive trade account was in surplus or deficit.

Table 2.2

Automotive Production - Canada versus U.S., 1978, 1982 and 1984
(Millions of constant 1984 Canadian dollars)

	Total Units of Canadian Vehicle Production	Total Units of U.S. Vehicle Production	Canadian Parts Shipments	U.S. Parts Shipments
1978 (Peak)	1.82 million	12.90 million	$7,823	$104,572
1982 (Trough)	1.24 million	6.99 million	$5,751	$69,065
1984	1.83 million	10.92 million	$10,232*	$102,800*
1984 as % of 1978	101%	85%	131%	98%

* Preliminary estimates.
Sources: Statistics Canada for Canadian data; U.S. data from U.S. Department of Commerce

THE VEHICLE COMPANY INVESTMENT

The major vehicle companies have helped lead the automotive recovery in Canada through both sharply higher production at their own Canadian vehicle and captive parts plants and increased purchases of Canadian-made parts here and in the U.S. The companies have followed their recent increases in production activity with plans for plant expansions and new investment. GM has announced a $1 billion program to retool and expand production at its Oshawa complex, $255 million to retool the St. Catharines engine plant for production of a new fuel-efficient V-6 engine, and $18 million to update production at the St. Thérèse assembly facility. AMC/Renault will be investing $764 million to build an ultra-modern plant at Brampton for the production of a new generation of mid-size cars. Ford has announced $105.7 million in new investment to expand production at the Windsor Essex engine plant, its Niagara glass facility and the Windsor aluminum castings plant. An additional $65 million has been committed to

Ford's electronics operation in Markham, Ontario. Chrysler, which completed a major new investment in its Windsor mini-van plant in 1983, will be spending $35 million to update production technology at its Pillette Road truck plant in Windsor as well. Total capital investment in the Canadian industry by all vehicle and parts producers will in 1985 be $1.2 billion and, with the announcements just described, should remain over $1 billion through 1987.

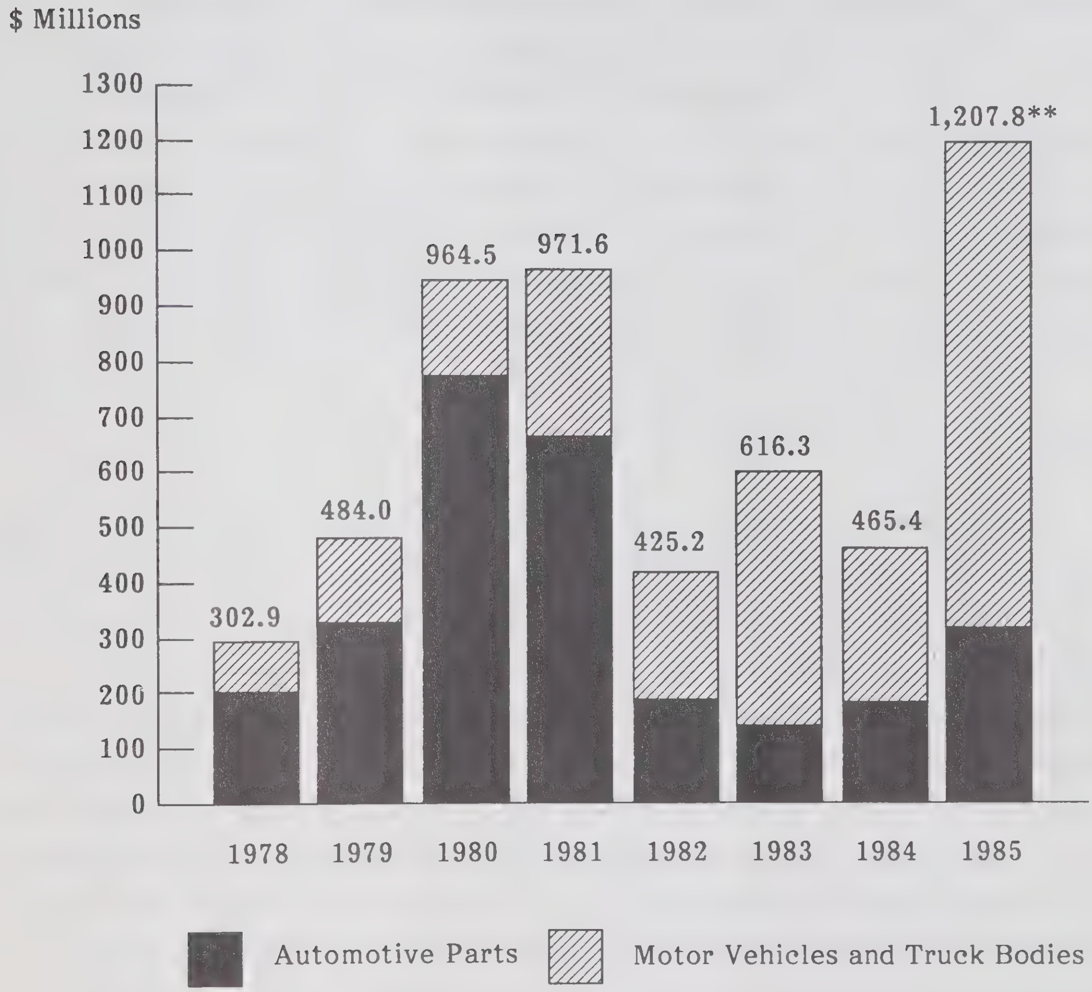
While much of this investment is to retool for new models, significant amounts are for advanced technology to reduce production costs and improve quality. In Chapter 3 we document how fast the industry is absorbing the new computerized forms of automation. At the same time as they are investing in automation, the vehicle companies are expanding their efforts to adopt the production management systems that were so essential to Japanese success. They are finding that both the automation and the production management systems are requiring new skills and significant training efforts. As we show in later chapters, training and human resource management have become essential to the strategies of the vehicle company as they restructure to meet competitive challenges.

It is important to note that three offshore vehicle companies will also be investing in Canada soon. The Korean car maker Hyundai has announced a $300 million assembly plant to open in 1988 in Bromont, Quebec, reaching full production of 100,000 cars a year by 1990. Honda has started to build a small-scale assembly plant worth $200 million in Alliston, Ontario, and Toyota has announced a $300 million assembly plant, to open in 1988 in Cambridge, Ontario. All these investments are welcome and important. But it must be kept in mind that the Honda and Toyota plants, together with the Toyota wheel plant in British Columbia, constitute the sum total of Japanese vehicle company investment in Canada. To put it in perspective, the Japanese car companies, with 18% of the Canadian auto market, have made investment announcements that total only two-thirds what AMC/Renault has committed to its new Brampton plant, -- and AMC/Renault had only 3.3% of the Canadian car market in 1984. Further, the AMC/Renault assembly plant will be sourcing parts and components out of the North American parts production system to a much greater extent -- at least initially -- than is anticipated from the Japanese plants. Sourcing parts and components from within

North America further contributes to the level of investment, and jobs in the automotive industry as a whole.

Figure 2.1

New Capital Expenditures for Plant and Equipment in the Canadian Automotive Industry*



* Excludes repair expenditures and tooling charges.

** Preliminary estimate.

Source: Statistics Canada Automotive Parts - SIC 325
Motor Vehicles and Truck Bodies - SIC 323, 324

THE PARTS INDUSTRY RESURGENCE

The Canadian parts industry has experienced a major resurgence since the recession. Output in 1984 hit $10.2 billion, up 154% in nominal dollars and 95% in real terms since 1980. This increase represents major gains by all segments of the parts industry. Generally, the industry can be divided into the in-house or captive parts plants of the vehicle manufacturers and the independent parts plants, which are outside vehicle company control. The independent parts industry in turn can be separated into the foreign-owned independents and the Canadian-owned independents. The captive portion of the parts industry represents 45% of total production, up from 41% in 1981. Also growing in terms of their share of total parts output have been the Canadian-owned independents which now make up 16.6% of the parts industry -- up from 14.8% in 1981 and up strongly from 5.5% in 1974. The foreign-owned independent parts producers have shrunk in terms of their portion of total parts production, but even they have increased shipments considerably since 1981.

The improved performance of all parts manufacturers is due in part to the overall recovery; but it also reflects the competitive advantages Canada currently enjoys over the United States. Most of the captive parts plants in Canada have been producing at very high rates of quality and at low production costs relative to U.S. plants. Canadian independent parts suppliers have taken advantage of lower Canadian labour costs while responding strongly to the demands of the vehicle companies for higher quality components. As we document in Chapter 3, the Canadian independent parts industry is in some cases ahead of the vehicle companies in implementing statistical process control, although to no small degree because of vehicle company pressure. Both independent and captive parts firms have also invested heavily in new production technology. Overall capital investment in the Canadian automotive parts sector in 1985 is estimated to reach $322 million -- up from $181 million in 1984.

Particularly exciting has been the rapid growth of the Canadian-owned independent parts manufacturers, which have tripled their output since 1981. Many of these parts firms have been trying to take advantage of the vehicle companies' desire to

Table 2.3
Structure of the Canadian Automotive Parts Industry
(Millions of dollars)

	1974		1981		1984	
	Shipments	Share	Shipments	Share	Shipments	Share
Vehicle Manufacturers' In-house	1,059	42.2%	2,015	41.3%	4,611	45.2%
Foreign-owned Independents	1,313	52.3%	2,142	43.9%	3,896	38.2%
Canadian-owned Independents	138	5.5%	722	14.8%	1,693	16.6%
TOTAL	$2,510	100%	$4,879	100%	$10,200 (est.)	100%

Source: Automotive Parts Manufacturers Association of Canada based on Statistics Canada.

sole-source when competitively feasible. The most aggressive Canadian firms are expanding their marketing efforts in the U.S. and trying where possible to forge closer links with the vehicle companies based on product development. Some of the larger Canadian firms, such as Magna International and Woodbridge Foam, are looking at opportunities to produce entire sub-systems for sale to the car companies. Magna, for example, aims to sell completed doors, dashboards, sunroofs and engine cooling systems. Similarly, Woodbridge hopes to manufacture the entire seating component ready for final insertion.

The parts industry has responded vigorously to the new competitive environment, and Canada's relatively lower labour costs have helped the industry expand its production even in the face of heightened competition from abroad. Future growth will

depend mainly on the industry's ability to sustain productivity gains and meet world-class quality standards. In the long run the industry will also have to invest more heavily in product development and technology to remain competitive. Both the trend to sole-sourcing and the investment required to remain competitive will encourage consolidation in the industry. There will be fewer suppliers and more large firms.

Several large Canadian firms are already growing quickly through mergers and acquisitions as well as internal expansion. In a few cases the Canadian management of a foreign-owned firm has made a leveraged buyout of its Canadian subsidiary operations. Several Canadian firms have also been quick to sign joint ventures with Japanese and European firms for technology transfer to Canada and joint production arrangements. Some foreign-owned parts firms are also scaling back their Canadian operations. All these developments add up to an expanded role for Canadian-owned firms within the parts industry, especially if safeguards are in place which ensure that sellers into the Canadian marketplace take advantage of domestic parts production capabilities.

About 75% of Canadian automotive parts production is sold to the vehicle companies for use in the manufacture of cars and trucks. This market is called the original equipment market (OEM). The other 25% of parts production is sold to the replacement market or aftermarket. Canadian firms have also been doing well in the parts aftermarket. Although the Japanese have been making a major push into the aftermarket to serve the steadily growing fleet of Japanese cars in North America. Many less developed countries are also targeting aftermarket opportunities in Canada and the U.S. In sum there will continue to be good Canadian prospects in the aftermarket to 1990, but offshore competition for those opportunities will be increasing.

TRADE POLICY WILL BE CRITICAL

In the new automotive world, trade policy has become a critical tool for managing industrial adjustment. As we saw in Chapter 1, all the major European and North American automotive countries have used trade restrictions aimed at Japan to prevent import levels from rising too high. In Europe governments are showing no interest in

easing those restrictions. Indeed, the European industry is going through a retrenchment that will last at least three more years and during which higher imports from Japan would be politically unthinkable.

In North America, however, trade restrictions are easing. The U.S. has lifted its voluntary restraint agreement with Japan, and though Canada still has an understanding with Japan to limit imports, it is a vague market share limit and not a more easily enforceable quota arrangement. Given the integrated North American market, the lifting of the U.S. VRA means that Canadian vehicle and parts production will be as vulnerable as U.S. production to any increase in Japanese imports. Although higher imports will cause the U.S. to lose production in its traditional domestic industry, it has some consolation in gaining thousands of jobs from Japanese investment in new U.S. vehicle and parts plants. As we noted in Chapter 1, in Canada current Japanese plans are for two small-scale assembly plants and a handful of small parts plants.

The single most critical policy issue before the federal government is what Canada can do to encourage high quality offshore investment. The current policy mix of verbal persuasion and a VRA with Japan have had limited success. These policies undoubtedly encouraged the Honda and Toyota assembly investments and, combined with the possibility of stiffer sanctions, probably helped stimulate the Hyundai assembly investment as well.

These new plants constitute important steps by three offshore producers to respond to concerns in this country that major vehicle importers invest and create jobs in Canada. As welcome as these investments are however as already noted, these plants are not expected to produce vehicles with high Canadian or even North American total content, or "value-added": initially at least, these plants will be assembly platforms for materials largely imported. Their indicated output is not likely to substitute for significant numbers of offshore imports; nor will it keep the overall level of imports into Canada from rising, particularly if the VRA is eventually removed. Moreover, the Canadian VRA offers little protection in the long run now that the U.S. has no VRA. As offshore imports to the U.S. increase and as the new Japanese assembly capacity in the U.S. and Canada comes onstream, some existing North American assembly capacity will be unneeded. Plant closings will be inevitable, and Canada will be as likely to

experience them as the U.S., given the integrated nature of the industry. In the new automotive world, the Auto Pact with its production safeguards is no longer the guarantor of Canadian jobs that it once was. It can continue to be a useful agreement, but needs to be supplemented with new policies to deal with the competitive threat from offshore. It becomes increasingly important for Canada to develop a comprehensive trade policy that can minimize the loss of jobs due to industry restructuring and that can ensure that offshore companies make investments in Canada commensurate with their positions in the market. It will be important also that Canada get a fair proportion of overall offshore investment in North America, including parts plants.

The federal government still has under consideration an alternative automotive trade policy put forward by the 1983 Federal Task Force on the Canadian Motor Vehicle and Automotive Parts Industries. That Task Force recommended a new trade policy regime that would extend the Auto Pact's basic requirements to all companies selling more than some number of vehicles in the Canadian market. Specifically, the Task Force suggested that all firms with annual Canadian sales of more than 28,000 vehicles be required to make commitments to the federal government comparable to the existing Auto Pact commitments of a one-to-one ratio of Canadian vehicle production to Canadian sales and Canadian value-added in production or purchased Canadian parts equal to 60% of the cost of sales in Canada. All vehicle companies with sales between 3,000 and 28,000 units would meet a proportionately smaller CVA requirement.

The 1983 Task Force argued that all major vehicle companies selling in the market, and not just Japanese producers, should be required to invest in Canada in proportion to their sales. The report warned of "new Japans" like Korea and stated that any new trade policy should be comprehensive and take account of all the new emerging producers. The federal government has yet to announce officially whether it will implement that Task Force's recommendation. If it did decide to proceed, this Task Force is also convinced that offshore investment in Canada would increase. If the government rejects the proposal, there are no other obvious alternative policies that might secure significantly increased offshore investment. In the following section we speculate on the likely size and scope of the Canadian industry given different trade policy regimes and other factors.

THE FUTURE SIZE OF CANADA'S INDUSTRY

Making an accurate forecast of the size of Canada's auto industry over the next five to ten years is extremely difficult. Nevertheless, it is important for purposes of our employment and occupational projections to have some sense of what range of futures is likely. We propose to develop three forecasts for the industry; together they should give a better sense of the possibilities before the industry than any single forecast could do.

In preparing the scenarios, we made certain assumptions that remain constant in all three cases. They are as follows:

- North American market growth of 1.5% a year from the 1984 level of 15,767,000 to 17,240,000 total vehicles in 1990.

- No significant change in U.S. auto trade policy from the present free trade stance.

- Canadian dollar no higher than 80% of the value of U.S. dollar.

- No significant increase in vehicle or parts exports from Canada to countries outside the United States.

These assumptions fall well within the forecasts of most industry observers. Market growth in North America is projected by almost everyone to be between 1% and 2% a year to 1990. We picked the mid-point of 1.5%. We have seen no major forecasts of the future value of the Canadian dollar to 1990 predicting it will increase to more than 80% of the value of the U.S. dollar. And no one in the industry expects Canadian exports to areas outside of North America to increase significantly.

In developing our scenarios we also ignored the cyclical nature of the industry. All the scenarios are forecasts for 1990 based on extrapolating from 1984, a peak production year. However, they should not be viewed as predicting that 1990 will be a

peak year but rather as giving a general sense of how much bigger or smaller the industry could become by that time.

We developed the three scenarios by making specific assumptions about four critical factors:

- Canadian trade policy towards offshore vehicle producers;
- the level of passenger car and commercial vehicle imports to North America[3];
- the level of offshore parts imports to North America; and
- Canada's share of total North American vehicle and parts production.

The assumptions in the three scenarios are summarized in Table 2.4[4].

We call the first scenario Universal Auto Pact. It represents what might happen if the federal government adopted the trade policy recommendation of the 1983 Task Force on the Canadian Motor Vehicle and Automotive Parts Industries. Under this scenario, Canadian trade policy in 1990 would require all companies selling vehicles in the Canadian market to create Canadian value-added (CVA) in vehicle or parts production equal to 60% of their cost of sales in Canada in 1990. Exceptions might be made for those selling very small volumes, but all major vehicle importers would have to invest in Canadian production facilities and/or purchase substantial quantities of Canadian-made parts.

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3. Throughout the report we use North America to refer to Canada and the United States.
4 The employment implications of our scenarios are the subject of discussion in Chapter 8.

Table 2.4
Major Assumptions Underlying the Three Scenarios for the Canadian Auto Industry in 1990

Assumptions	1984 Actual	Scenario 1: Universal Auto Pact	Scenario 2: More of the Same	Scenario 3: Import Flood
Total Canada and U.S. Vehicle Sales	15,767,000	17,240,000	17,240,000	17,240,000
Canadian Trade Policy	VRA with Japan at 18% of cars	60% CVA required of all vehicle sellers	VRA with Japanese in 18-20% range	No import restrictions
Import Share of Canada/U.S. Market				
Passenger Cars	24%	31%	31%	41%
Commercial Vehicles	15%	19%	19%	21%
Total Import Share	21%	28%	28%	35%
Import Share of Canada/U.S. Parts Market	8%	12%	12%	16%
Value-added in Canada as % of Total Canadian/ U.S. Automotive Value-Added	8.4%*	10.9%**	9.6%	7.7%

* Canada Consulting Group estimate based on available data.

** Of this 10.9%, 2.1% represents value-added directly created by the new trade policy in Scenario 1.

Under the Universal Auto Pact scenario, vehicle imports into North America would rise to 28%, primarily because of the unrestricted U.S. market. Within this, passenger car imports would have risen to 31% of the passenger car market from 24% in 1984 (and 25% in 1985). Commercial vehicle imports would have risen to 19% of the commercial vehicle market from 15% in 1984 (and 17% in 1985). We assume offshore parts imports would also increase to 12% from the current 8% of the market. But because of the 60% value-added requirements, these import increases would not have a significant negative impact in Canada. Instead, Canada would be assured of production

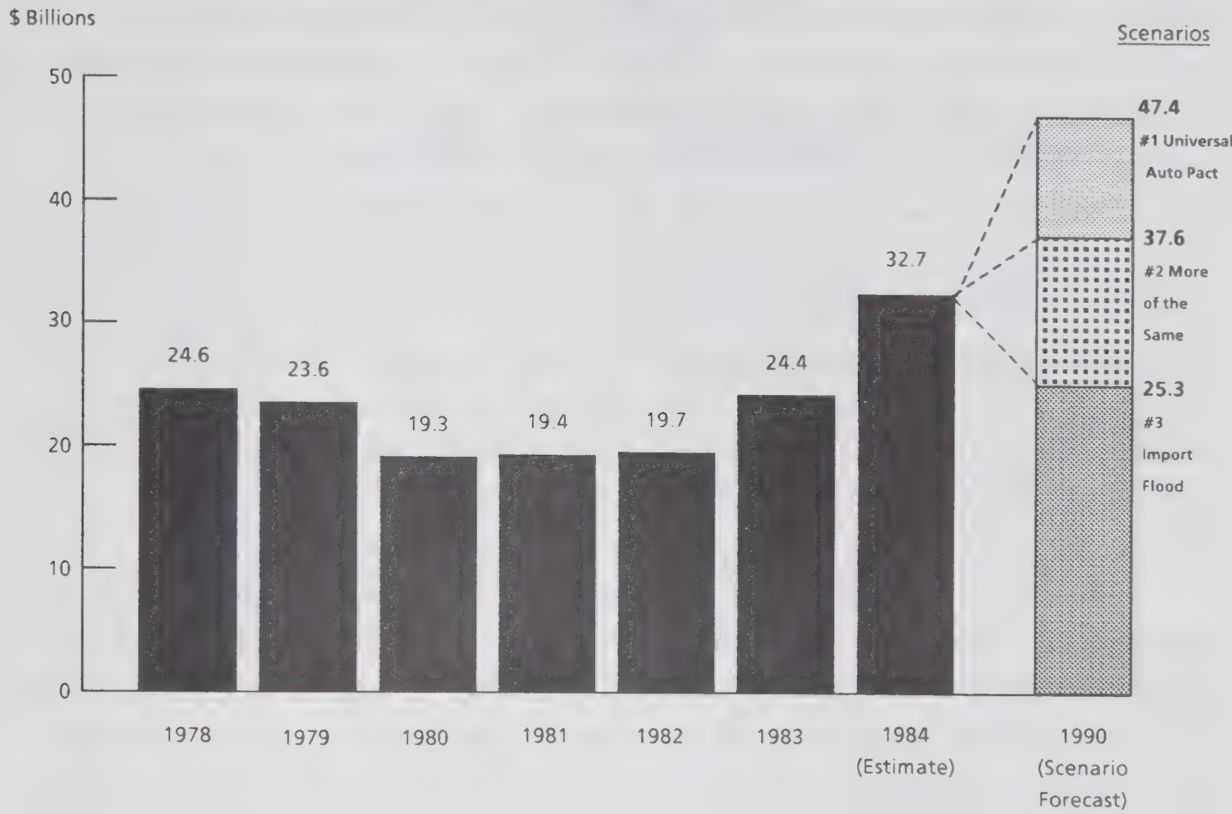
value-added equal to at least 60% of the total value of sales in the Canadian market. Because of the value-added requirements and because the additional investment by offshore producers would stimulate increased Canadian parts production that might feed U.S. plants, we estimate the automotive value-added in Canada as a percentage of total North American value-added would rise to 10.9% -- well above the 1984 estimated level of 8.4%. Of this rise about 2.1 percentage points would be due directly to the 60% value-added requirement in the new trade policy.

The overall result of the assumptions in the first scenario is that the Canadian auto industry would grow from net shipments of $32.7 billion in 1984 to net shipments of $47.4 billion in 1990 -- a gain of 45% (see Figure 2.2). In effect, this scenario has the Canadian auto industry outperforming the U.S. industry because of a vastly different trade strategy. Whether the U.S. would stand idly by as Canada obtained significant offshore investment by this means is open to question. However, the U.S. has already reaped significant offshore automotive investment and might have little reason to object to Canada applying trade leverage to gain significant investment from offshore firms.

The second scenario we call More of the Same. It represents a general continuation of current policies. Under it Canadian trade policy in 1990 might look very much like trade policy today, with some type of voluntary import restraints holding the Japanese to between 18 and 20% of the market. Because the U.S. market would remain unrestricted and the Canadian market would be totally open to offshore imports from countries other than Japan, we again estimate the overall vehicle import level in North America would rise to 28%, consisting of a 31% passenger car import penetration and a 19% commercial vehicle import penetration. We also estimate in this scenario that the trend to greater offshore sourcing of parts would raise parts import levels to 12% of the North American market.

Figure 2.2

Three Scenarios for Total Shipments in the Canadian Automotive Industry to 1990 (In billions of constant 1984 dollars)



Source: See Table 2.1 for 1978-1984. Forecasts in 1990 are from The Canada Consulting Group Automotive Industry Model.

A critical and difficult assumption to make in this scenario concerns what would happen to Canada's share of the total value-added in the North American industry. Under this scenario we project that Canadian value-added would increase as a proportion of total North American value-added, from an estimated 8.4% in 1984 to 9.6%. For CVA to reach 9.6%, a number of developments would have to occur. In the first place Canada's parts industry would have to keep growing at a rate significantly above growth in the U.S. parts industry. This would continue the trend between 1979 and 1984, during which the Canadian parts industry grew by 31% in real terms; at the same time, the U.S. parts industry was smaller in 1984 in real terms than it was in 1978 before the recession. In the second place the North American vehicle companies would

need to continue to maintain a high level of investment in Canadian facilities. Given a Canadian dollar worth no more than 80% of the U.S. dollar and a corresponding labour cost advantage in Canada, it is certainly conceivable the U.S. vehicle companies would want to maintain a high level of investment in Canada. However, growth in total market size will not be sufficient to offset increased import penetration under Scenario 2, and the additional 1.66 million units of Japanese and Korean capacity anticipated between 1984 and 1990 represent yet more units of production not required in the projected marketplace (See Table 2.5). Up to a million additional units of Big Four passenger car capacity will also be coming on stream between now and 1990. Some plants will have to close or operations in general will have to be scaled back. Given the U.S.-UAW collective agreement job bank guarantees and the U.S. protectionist mood in general, it will be imperative that Canadian facilities maintain high quality and productivity levels if the Canadian share of North American value-added is to be maintained or increased.

The third development we are anticipating in the second scenario is more problematic. To attain a larger portion of total North American production, Canada will need to secure some major offshore investments. The announced Canadian Toyota, Honda assembly plants could be the beginning of that investment growth, especially if the plants are expanded to production volumes of 150,000 to 200,000 vehicles a year. They could also encourage the location of Japanese parts plants in Canada to hook up with their anticipated just-in-time supply systems. The continuation of the VRA would also be an inducement to other Japanese vehicle companies to locate production facilities in Canada. It would not be impossible for the Canadian industry to reach 9.7% of total North American value-added without additional offshore investment, but it would be very difficult. It would also be difficult if the investment which does come to Canada adds a capacity without making a contribution to value-added commensurate with any parts or assembly production which is displaced.

Table 2.5

Structure of the North American Passenger Car Market
1984 Actual & 1990 Scenarios
(000s of units)

	1984 Actual		Scenarios 1&2		Scenario 3	
Total Canada & U.S. Passenger Car Sales	11,360	100%	12,400	100%	12,400	100%
Imported Passenger Cars	2,685	24%	3,850	31%	5,090	41%
Non-Auto Pact Passenger Car Production	140	1%	1,660*	14%	1,660*	14%
Auto Pact Passenger Car Production	8,535	75%	6,890	55%	5,650	45%
Auto pact Production -- reduction from 1984			(1,645)		(2,885)	

* From Table 1.3 based on facilities announced as at December, 1985. Actual production could be higher, with up to 500,000 additional units of non-Auto Pact capacity known to be under consideration by several offshore manufacturers either independently or in partnership with Big Four manufacturers. Certain of these non-Auto Pact manufacturers have announced intentions to qualify under Auto Pact but it is unclear whether they will satisfy requirements by 1990.

The net result of assumptions in the second scenario is that overall shipments in the Canadian industry would increase by 15.1% to $37.6 billion in 1990. Three-fourths of this increase would result from the increased Canadian share of North American value-added and one-fourth from the growth of the overall vehicle market. However, the overall level of Canadian output would be 11% higher in 1990 under this scenario were it not for the higher levels of vehicle and parts imports.

The third scenario is called Import Flood because under it vehicle imports are assumed to rise to 35% of the total North American market. Passenger car imports rise dramatically to 41% of the North American market - almost half as high again as the 28% peak import level reached in 1982 - and commercial vehicle imports also rise, to 21% of that market. We also assume that parts imports would increase to 16% of the North American parts market. Under the third scenario, Canadian trade policy would consist of no import restrictions other than normal tariffs. We also assume the Canadian share of total North American value-added would fall to 7.7%, mainly as a result of a disproportionately larger amount of offshore investment going to the U.S. in the absence of any Canadian restrictions on offshore producers. In any case 7.7% is still a higher level than that achieved by the Canadian industry in 1972-73 and 1976-80.

These assumptions result in a 22.7% real decline in Canadian industry shipments under the Import Flood scenario. Such a decline would result mainly from the higher level of vehicle imports, especially the level of passenger car imports although the high parts import level and the decline in Canada's share of North American production would play a role, too. As we show in Chapter 8, when we translate these scenarios into employment projections, the Import Flood scenario would have serious ramifications for many auto workers. The combination of higher vehicle imports with the new capacity of Asian producers in North America would create excess capacity in the industry of some 2.8 million units -- equivalent to 11 traditional full-scale, two-shift assembly plants each producing 250,000 vehicles a year. To the extent that this offshore investment consists of merely assembly platforms with low North American value-added, there would be further negative effects on the parts industry. As table 2.5 shows, non-Auto Pact, North American-based passenger car production in 1990 could account for 14% or more of North American sales.

All told, under Scenario 3, tens of thousands of automotive jobs stand to be lost in Canada alone, and the impact of this job loss would be felt beyond the industry to the economy at large. Because of its serious negative implications for many individuals and communities, not to mention the economy as a whole, it is difficult to imagine Scenario 3 being allowed to happen. It is not impossible, however, particularly given how powerless Canada is to change U.S. market policies. If the U.S. were willing to tolerate

the immense dislocations and social costs of a 41% passenger car/21% commercial vehicle import level, Canada's political options would be narrowed even as events increased the urgency of moving to trade policy as contemplated by Scenario 1.

We have described three possible but very different scenarios for the industry. We believe they give a good sense of the overall range of prospects for the Canadian automotive industry in 1990. That the range varies from 45% larger to 23% smaller than the industry was in 1984 says a great deal about the uncertainties the industry faces. Even in the best scenario, with the industry growing by 45%, a higher level of imports to North America will be inevitable given U.S. government policy. It is possible, though, that despite higher imports, Canada can still expand its industry vigorously. Canadian success will depend on four main factors:

1. The government of Canada must pursue a trade policy that will result in higher investment by offshore manufacturers or significant purchases of Canadian-made parts.

2. The Canadian operations of the North American vehicle companies will need to continue their strong record in productivity and quality improvement.

3. The Canadian independent parts industry will need to continue its aggressive approach to expansion, selling especially to the new Japanese and Korean plants in the U.S. and Canada.

4. Labour and management in Canada will need to find ways to develop a human resource strategy that takes the best of the new models of work organization and tailors them to the Canadian environment.

It is clear that despite the high level of foreign ownership in the industry, its future will depend very much on decisions and actions taken by Canadians. Trade policy and competitiveness are both factors over which Canadians have significant control in this industry. Unlike resource industries, there are no natural competitive advantages in the automotive industry. Canadians created a vigorous and healthy automotive sector. It will be up to Canadians to sustain it.

REGIONAL SHAPE OF THE INDUSTRY

The automotive industry in Canada has historically been concentrated in Ontario and Quebec. About 89% of all automotive employment is in Ontario and 9% in Quebec. A few smaller bus, truck and car assemblers have plants in other provinces, including a car plant in Nova Scotia, two bus plants in Manitoba, and four truck plants and an aluminum wheel plant in British Columbia. More than a score of independent parts plants are also scattered across the Maritimes and the western provinces. Policy makers have tried to encourage automotive investment in other regions, but the industry has remained generally tied to a belt from Windsor to Montreal with major concentrations in Windsor, St. Thomas/London, Chatham, Kitchener, St. Catharines, Oakville, Toronto, Oshawa and the Montreal region.

There have been logical reasons for this. Historically, the automotive industry grew up around Detroit, and it was natural that early Canadian plants should be close to Detroit. More recently, the industry has favoured Ontario and Quebec locations because of their proximity to the bulk of the Canadian and U.S. auto markets and because of their large supplies of skilled labour. This concentration has had a momentum of its own as vehicle companies seek locations near their suppliers and vice versa.

The competitive and technological changes under way in the industry have ramifications for the regional distribution of the industry. One of the most profound shifts is the move to just-in-time inventory systems (described in detail in Chapter 3). In these systems the vehicle companies no longer keep major banks of parts inventory. Instead, their parts suppliers are expected to deliver on a frequent basis, once or twice a day in some cases, just the amount of parts needed for the vehicles to be produced before the next delivery.

In Japan, where the just-in-time system originated, parts suppliers are located close to the assembly plants and just-in-time is relatively easy. With a more dispersed industry in North America, it will be harder to move to a just-in-time system. Nevertheless, the vehicle companies are beginning to do so and are pressuring parts

suppliers to locate near assembly plants. The vehicle companies are also developing major integrated assembly and parts complexes in selected locations. Buick City in Flint, Michigan, has been a prototype for such developments. The Oshawa complex in Ontario is rapidly becoming such a development for GM Canada.

The pressures of the just-in-time system are likely to increase regional concentration in the industry. Because of the many assembly plants already in Ontario, Ohio, Indiana, Illinois, and Michigan, most parts companies looking for a Canadian location will favour Ontario or Quebec. Vehicle companies looking for new assembly locations will favour southern Ontario or southwestern Quebec for their existing parts suppliers and proximity to parts facilities in the U.S. Honda and AMC/Renault both chose Ontario locations in part for these reasons.

The outlook for other provinces is less favourable, although British Columbia could be a possible location for additional Japanese investment as California has been in the U.S. But this would be most likely if the plants manufactured parts that could be shipped back to Japan. In addition, many smaller parts are not likely to be delivered on a just-in-time basis. Fasteners, clamps, brackets and similar parts will be delivered in larger lots and less frequently. These kinds of parts could presumably be made almost anywhere in Canada.

The competitive restructuring under way in the industry will also have major implications for the local distribution of the industry even within its present regional boundaries. If offshore producers make major investments in Canada, they could develop new automotive centres in communities that currently have little auto activity. As those offshore firms develop Canadian and other North American facilities, they will inevitably make some existing North American capacity redundant. Thus, other communities that already have major automotive facilities may suffer plant closures and the loss of auto jobs. While much of this restructuring will take place within southern Ontario for the reasons mentioned earlier, it will still mean the decline of some regions and the enhancement of others, with the result being the mobility and adjustment problems attendant on any major industrial restructuring.

CHAPTER 3

THE NEW TECHNOLOGIES

The history of the automotive industry in North America between World War II and the early 1980s was one of striving for productivity gains. Longer and longer production runs took place in increasingly specialized plants -- engine plants, transmission plants, trim plants and so on.

Productivity gains took place, however at the expense of flexibility. Large plants capitalizing on perceived economies of scale meant that product innovations were riskier if they involved any amount of retooling. The product innovation that did take place occurred only with long lead times, measured in years, or at very substantial cost, such as with the forced introduction of emission controls in the mid-1970s. Long production runs in a buoyant market with little foreign competition also had an effect on product quality. Auto makers accepted a certain level of quality problems as an inevitable consequence of maintaining economic production.

Japanese innovations forever changed this view of the world. Japanese auto makers have demonstrated that efficient production can be achieved with relatively small plants and that extremely high quality can be achieved without forcing up costs. The new technologies of the Japanese and, to a lesser extent, those of the Europeans have rewritten the industry standards for productivity and quality. North American automotive companies have had no choice but to respond. Comprehensive change in both product and production technologies is the centrepiece of the North American industry push to reassert itself in its own markets.

Changes in **product technology** have had an impact on virtually all vehicle systems and components. Front wheel drive and fuel injected engines have radically altered

power train configurations. High-performance plastics and alloys are replacing steel in engine components, bumpers, even body panels. Microprocessors are controlling engine, transmission, suspension and braking functions, as well as passenger compartment conditions.

Product technology, however, can be readily copied by the competition. **Production technology** on the other hand can be copied successfully only with concerted effort. It is in this area that the real battle for supremacy is being fought, with profound effects on the nature of the work environment. Production technology is therefore the focus of this chapter.

Production technology can be either "hard" or "soft". Hard technology refers to the kinds of physical plant, machinery and equipment used in the production process. Soft technology refers to the way people and equipment are organized in relation to each other and the tasks at hand. In this chapter we examine both kinds of technologies. Among the soft technologies, we highlight

- statistical process control (SPC),
- just-in-time (JIT) production and delivery, and
- quick tool and die change.

Significant progress in implementing the soft technologies is imperative if the industry is to achieve the productivity levels of Japanese manufacturers. Further, once in place, soft technologies create a solid basis for capitalizing on the potential of the emerging hard technologies. Among the hard technologies, we discuss

- programmable automation
- robots,
- computer-assisted design (CAD) and derivative technologies, and
- emerging equipment technologies.

In each case we look at the technology itself, its rate of adoption in Canada, and its impact on the workforce.

One of our clear findings is that the impact of any technology on the workplace can never be simply a side issue. How technology is integrated with those on the shop floor has a bearing not only on the technology's contribution to productivity and product quality, but also the quality of the lives of the people working with it.

SOFT TECHNOLOGY

Soft technology refers to the way people and equipment are organized with respect to each other and to the tasks at hand. Although these technologies have not received as much publicity as the equipment technologies discussed later in this chapter, they are even more important to the future success of the automotive industry in North America. As we describe them, it will become clear that none of the soft technologies necessarily requires large capital expenditures to implement -- as compared, for example, with the cost of introducing equipment technologies. Nonetheless, companies do have to make significant investments in time, training and commitment. Moreover, the effect of these technologies on the operation of the workplace is necessarily profound. Equally significant and crucial to their success, then, is the management/labour relations context in which they operate. We discuss this aspect of technological change in Chapter 4.

STATISTICAL PROCESS CONTROL

A traditional tension in North American manufacturing has been that between those in charge of production and those in charge of quality. The goal of production was to get as much out the door as possible. The goal of quality control was to allow only satisfactory products to leave the plant. It was taken as axiomatic that compromise was necessary: production people were allowed to produce as much as required, but quality control inspected the results, scrapping or designating for rework all production that failed to satisfy requirements. Of course, if scrap or rework levels got too high,

the production people had to respond because they were evaluated not only on output levels but also to some extent on scrap and rework levels.

Two features of these arrangements stand out. First, some level of quality problems was accepted as inevitable. Second, responsibility for quality was out of the hands of production workers, who were hired to do specific tasks. Apart from the expectation that they would do the best job possible, their role in quality control was negligible.

The Japanese approach to quality has been entirely different. Rather than set minimum defect standards, the Japanese set the standard at **zero defects**. To achieve this, they adopted a fundamentally new philosophy of production, one where production people and quality people become one and the same. Nobody is an inspector because everybody is an inspector, of his own work and the work of others. Rather than driving up costs to uneconomic levels, as traditional North American manufacturing wisdom assumed would happen, the Japanese approach to quality actually reduced costs by lowering scrap and rework levels and improving total worker productivity.

Of vital importance to the Japanese approach to quality is statistical process control (SPC), a proactive, mathematically-oriented method of improving quality in the manufacturing process.

The first step towards understanding SPC is to understand that no two pieces are ever made exactly alike. Whether it is variations within a part itself or among parts produced at different times, at some level of precision there will always be differences. These variations occur for many reasons. Machine variables change, for example, as tooling wears down. Operator, material and environmental factors will also vary over time.

Not all variation is bad. In some cases, variation will make no difference to the quality of the product. In other cases, the variation is sufficiently severe to cause the part or product to be defective. SPC uses simple statistical techniques to study variation and, where there are quality problems, to gain an understanding of what is required to correct them.

When a product is designed, an engineer specifies the characteristics the product should have, such as its dimensions, the quality of the materials going into it, its weight, and so on. The engineer also specifies the variation allowed around each of the characteristics. For example, the specifications might require that a product be at least 18 cm long, or that it should be no less than 0.99 cm thick and no more than 1.01 cm thick.

At a first level of complexity, SPC is used to track whether a product meets the specifications laid out by the engineer. In its more advanced applications, however, SPC can be used to gain an understanding of the sources of variation in the manufacturing process and to predict and correct quality problems.

SPC is deceptively simple to describe. At regular intervals during the production run of a product, samples of the product are checked for conformity with the characteristic(s) known to be critical at each of the important steps in the production process. The results are recorded in numbers and in points on a graph showing what the numbers are and how they compare with the specifications.

As more and more samples are taken and graphed, a pattern emerges. The pattern may show that the part is being produced to specifications. Or, it may show that the process is tending increasingly to produce bad parts or is already producing bad parts. If so, why this is happening must be analyzed. If the problem is serious enough, production could be stopped until the problem is solved.

Several features set SPC apart from quality control methods used previously. First and foremost, its application can be handled by production workers, not just by the quality control department. The production worker can be assigned responsibility for tracking the quality of the parts being made.

Secondly, SPC can be used to great effect to track not just whether a product is within specifications, but also trends within the specification boundaries. As a result, potential problems can be caught even before they result in defective parts. Taking this concept one step further, SPC can also be used to experiment with the variables within the manufacturing process in order to gain a thorough understanding of what affects the

product's characteristics. For example, in the case of castings, the effect on the product of increasing or decreasing the temperature at which molten metal is held before being shot into a die can be tracked.

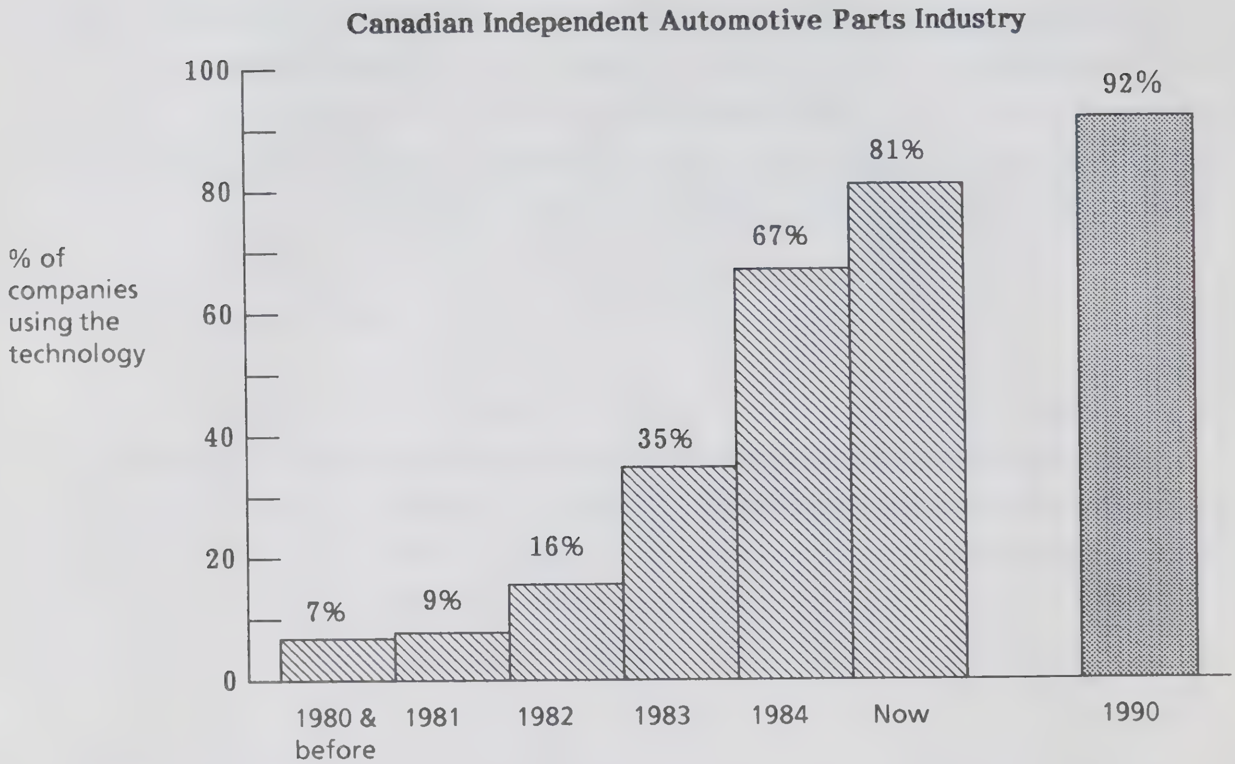
By itself, however, SPC is only a diagnostic tool for use in more general problem-solving applications. The use of SPC can result in better understanding of the production process. Using this understanding to improve the process or to solve quality problems is another aspect of the Japanese approach to quality. It is an approach that emphasizes the involvement of production workers in new ways.

Rate Of Adoption

SPC was originally championed by a small number of American engineers, most notably Dr. W.E. Deming and Dr. A.V. Feigenbaum, but it was Japanese manufacturers that recognized its potential and took up the challenge. The effect on quality of its successful implementation became clear to the North American auto industry in the late 1970s, and the push to implement it began with the major assemblers in the early 1980s.

Introduction of SPC in the Canadian automotive parts industry has increased sharply in the last five years. Only 7% of parts companies were using SPC before 1981, but now 81% have introduced it (see Figure 3.1). Among the large firms and those concentrating on the original equipment market, usage is even higher (see Table 3.1). Currently, Canadian independent parts manufacturers as a group are further along than the assemblers in the degree to which they are using SPC.

Figure 3.1
SPC Introduction



Source: Task Force survey of the Canadian independent automotive parts industry. See Appendix 2.

Although the part manufacturers are leading the introduction of SPC, it should be noted that it was the assemblers that required the parts manufacturers to adopt SPC. The rise in SPC introduction after 1981 was related directly to decisions by the assemblers to make the use of SPC by their suppliers a condition of dealing with them.

An excellent example of the use of SPC is at the General Motors Windsor Transmission Plant. Plant personnel are implementing an ambitious plan that will see the number of process characteristics controlled via SPC rising to over 1,200 within two years. Even now, 125 characteristics are being monitored, with every one of the

Table 3.1
SPC Introduction - Current & 1990 Anticipated
Canadian Independent Automotive Parts Industry

Company Size	Have Introduced SPC Now		Will Have SPC By 1990
More than 500 employees	96%	-	100%
100-499 employees	84%	-	96%
Fewer than 100 employees	69%	-	84%
Destination of Parts		-	
OEM-oriented	89%	-	97%
Aftermarket-oriented	56%	-	78%

Source: Task Force survey of the Canadian independent automotive parts industry.

approximately 60 work areas in the plant monitoring at least one characteristic. Forty full-time hourly SPC coordinators chosen from the ranks of the workforce have been trained to assist the work areas in the use of SPC.

As an example of an application in an assembly plant, SPC is being used to advantage at the Ford St. Thomas plant. There, sources of variation in hood openings and door/quarter panel margins and sources of failure in electrical systems are among the process characteristics to which SPC techniques have been applied.

From field work it is clear, however, that both the assemblers and the parts manufacturers have just begun to tap the potential of SPC. The technology is so powerful and so complex that full implementation can take three to five years. Most companies in the industry began using SPC only within the last two years.

The field work also revealed that not everyone with SPC training fully comprehends its potential. Some still view SPC as something they have to do to comply with contract requirements rather than as an important tool for improving quality. Acceptance of SPC on the shop floor has been another stumbling block at some plants,

with the introduction of SPC becoming embroiled, to its detriment, in the larger issues of productivity and job content.

Impact On The Workforce

By definition, the soft technologies are about people, and SPC is no exception. The issue with SPC is not so much one of worker displacement, although SPC will have a potentially negative impact on the inspector classifications. In the Canadian industry, 6% of the assemblers' and 5% of the parts manufacturers' workforces are inspectors -- of incoming parts and supplies, work-in-progress, or the final product.

In a plant with full SPC implementation, there are no incoming parts or in-process inspectors and few, if any, final inspectors. It will be a number of years -- beyond 1990 -- before the North American industry reaches this point. However, such a situation has to be an implicit target of the industry's plans for SPC.

The bigger and immediate impact of SPC is its effect on the job content and skills required of production workers. SPC does not have to be used by production workers. Some companies are deliberating not using SPC at this level. One plant manager summed up this view by saying he did not believe he could get production workers to inspect their own work. This approach does not appear to be the norm, however. Most companies are trying to introduce at least some of their production workers to SPC. Some 63% of parts companies surveyed had given at least some of their hourly workers some SPC training in the last two years. Among these companies, an average of 27% of the workforce had received SPC training.

The mathematical skills required for SPC are not onerous, but for the average worker they are new skills nonetheless. To understand SPC workers have to be comfortable with basic statistical concepts such as frequency distributions. Using SPC without computer assistance requires calculating averages and sum squared differences from averages. It is not uncommon to find, however, that a company has provided computer aids to SPC use, which perform all the calculations and even chart the results.

Ideally, SPC supplements a broader team approach to problem-solving. Here, too, new skills are required -- skills in communication, group dynamics and cooperative action. It is in this area that SPC programs often falter. Workers can be given the mathematics and the SPC techniques, but often never proceed to the next step, group problem-solving. Instead, SPC becomes just another task. The charts are filled out and turned into management to fulfil job requirements, but remain largely unanalyzed.

Assemblers and parts manufacturers alike told the Task Force that SPC is having a major impact on their workforces. The cost of training is high, and the gains are slow and uncertain. While most are finding the skills of their workforces adequate, some are struggling. Entrance standards to the industry are higher than ever before, with many companies considering a high school diploma a minimum entry requirement. The training requirements posed by SPC are discussed more fully in Chapter 6.

SPC is not the only soft technology making inroads. JIT is another, and one with even greater implications for the workforce.

JUST-IN-TIME PRODUCTION AND DELIVERY

Every manufacturer is faced with decisions about how much to produce, when to order the materials needed for production and how to organize buffer stocks within the production process.

The traditional approach in North American manufacturing has been to establish inventories of both incoming supplies and work-in-progress. Exact levels are determined by the economics of production runs and by the potential costs associated with unanticipated interruptions of deliveries from suppliers and unanticipated interruptions of the production process.

The power of computers has been brought to bear on the problem of managing inventory which becomes complicated indeed as the number and complexity of manufactured products increases. Materials Resource Planning (MRP), used widely in

the automotive industry, calculates optimal stock levels and reorder dates by comparing production requirements with inventory costs while taking into account the potential cost of running out of stock. MRP does not, however, address the problem of buffer stocks within the production process.

A different approach, just-in-time delivery and production (JIT), was developed in response to the same inventory management issues. Used to great advantage by the Japanese, JIT involves producing and delivering products at the specific time they are needed. The underlying goal is to eliminate inventory, making all material part of the work-in-progress.

At the heart of JIT is a reliance on much smaller batch sizes and the balancing of various manufacturing processes for maximum utilization of personnel and equipment. By reducing set-up times and improving quality, buffer stocks can be reduced significantly or even eliminated. For example, in 1980 an auto assembler might have had several weeks' production of seats on hand. Now, assemblers may take hourly deliveries of seats of the precise colour and materials required for that day's production. Planning is such that seats can be unloaded from the delivery truck in the exact order that they are required on the assembly line.

JIT may appear to be simply a better inventory system but its real significance goes deeper. JIT is an approach to quality control and production cost reduction. Because there is little or no inventory, all quality has to be good, including the quality of incoming materials, work-in-progress and finished goods. Any problems in the production process have to be discovered and solved quickly; there are no buffer stocks to keep production going while the trouble is sorted out. Preventive maintenance becomes more valuable, because the increased machine utilization that is often part of the JIT process puts a high premium on machine reliability.

As with SPC, JIT challenges traditional notions about production costs. Rather than rising to uneconomic levels, costs can be even lower than under the old North American philosophy of "just-in-case" buffer stocks. Scrap is reduced and quality increases because the process leaves no room for producing bad parts. Flexibility is enhanced because lower inventory levels and smaller production run capabilities

allow quick changeovers to the production of different products. Productivity increases because the premium on machine uptime, a relatively less important part of the old North American approach, is greater, resulting in better machine upkeep. In addition, a lean JIT process will be "in balance", that is, its people and machines will be organized for optimal distribution of the work load.

Rate Of
<u>Adoption</u>

All major North American automotive assemblers are moving to JIT internally. They are also requiring it of their suppliers as a condition of contracts. In the automotive parts industry survey conducted by the Task Force, 62% of respondents reported using JIT concepts on at least a trial basis, with their customers. Fully 86% expected to have introduced JIT delivery by 1990.

Full implementation of JIT involves far more than simply more frequent and more prompt deliveries. Parts manufacturers will also have to start dealing with their own suppliers on a JIT basis. Otherwise, JIT will be simply an exercise in shifting inventory from assembler warehouses to those of parts manufacturers. Only 37% of survey respondents reported having such JIT links with their suppliers.

Full JIT will also generally require computer hook-ups between the assemblers and their suppliers. With 44% of suppliers in the survey reporting these links in place, substantial progress has been made, but the majority of suppliers have yet to be connected. Computer links are important because they enable an assembler to communicate quickly with its suppliers about production requirements. These links also allow the assembler to monitor production and inventory levels among its suppliers.

Above all else, however, JIT will reach its full potential only when the quality levels associated with SPC are firmly in place. Only then will it be possible to reduce in-process inventories substantially, resulting in true JIT production.

The field work by the Task Force indicates that JIT is only in its early stages in Canada. Most efforts to date have concentrated on enhancing communication between assemblers and suppliers and eliminating transport bottlenecks. Reducing the number of suppliers has been a significant part of this effort by both the assemblers and their direct parts manufacturers. The impact on inventory levels is already being seen: the Ford Essex engine plant has reduced average inventory levels from about 15 days in 1982 to a current level of about 6 days.

Full implementation of JIT in the Canadian system will take at least 5 to 10 years. An issue yet to be resolved is how JIT delivery will evolve in the North American context. In Japan, the automotive industry of necessity is highly concentrated geographically. In the future, the North American industry will be less dispersed than it is now; parts manufacturers will cluster around their assembler customers more so than in the past. The question that remains, though, is just how dramatic this geographic restructuring will be.

Impact On The Workforce

JIT has both displacement and job content implications for the workforce. The displacement is of two kinds. First, the greater operating efficiencies associated with JIT production may not be matched by higher output levels, squeezing workers out of production. Second, the clustering of suppliers associated with JIT delivery will lead to disruption of supplier workforces when suppliers move to be closer to the assemblers. The reduced number of suppliers will also be a source of disruption as displaced workers from excluded companies move on to other opportunities, either in or outside the automotive industry.

Job content changes are also likely to be twofold. First, as with SPC, a team approach to problem-solving is required to make JIT work. Again, workers will need a good grounding in communications and group skills.

Second, especially when it is implemented poorly, JIT delivery and/or production can raise stress levels in the workplace. If quality is significantly less than perfect, if deliveries arrive late, or if machines break down with any degree of regularity, but the workforce is neither involved in solving these problems nor kept abreast of efforts being made to solve them, the quality of the work environment can be significantly compromised. The situation can deteriorate further if the worker continues to face pressures to maintain production levels.

While we found no specific examples of companies where stress levels had increased permanently, we found a great deal of anecdotal evidence of the problems companies experience as a result of introducing JIT.

QUICK TOOL AND DIE CHANGE

Manufacturing equipment is often used to produce several kinds of products. A stamping press, for instance, may produce fenders, hoods, trunk lids and other body panels. However, there are costs associated with changing from the production of one kind of stamping to another. Not only are there the direct wage costs of those involved in setting up the equipment for a new production run, but there is also the cost of lost production while equipment sits idle during the changeover.

For some of the larger presses, with dies weighing several tons, it can sometimes take several days to change the dies to produce a different part. Even after the die has been changed, the first few pieces are often defective, and more time is eaten up making final adjustments to eliminate the problems. The longer it takes to change the equipment from one type of production to another -- known as "set-up time" -- the more it costs.

For many years the North American automotive industry worked on the assumption that certain set-up times were the norm; they therefore maintained production runs as long as the offsetting inventory costs dictated were economic. Spurred on by the success of the Japanese, manufacturers have been taking a new look

at set-up times, using a bundle of concepts often referred to as "quick tool and die change". Applying the concepts can involve prohibitive capital expenditures on plant and equipment reconfiguration, but this need not be the case. In part, the concepts are simply a way of thinking about the process of tool and die change. For example, in some situations set-up times can be improved at little cost by examining in detail how a die is changed and moving as much of the procedure as possible to the period when the machine is still running. On the other hand, the installation of specialized equipment to speed up the physical transfer of dies in and out of a machine can be extremely costly.

The case of A.G. Simpson is an example of a company achieving significant savings at little cost. The set-up time of a 600-ton press was reduced from 6.0 hours to 2.1 hours simply by thinking through and refining the set-up procedures. Other time savings have been even more dramatic. Assisted by capital outlays, some U.S. stamping plants have seen die change times fall from several days to 15 minutes or less.

The connection between shorter set-up times and JIT is an important one. If the minimum economic production run for a particular part is two weeks because it takes a full day to change the die, the flexibility to produce only what is needed when it's needed is greatly compromised. Set-up times of 15 minutes, however, allow for daily die changes if required. Other U.S. manufacturers report die change times falling from one hour to a few minutes. For these manufacturers, set-up times on those pieces of equipment cease to be constraints on production run decisions.

Rate Of
<u>Adoption</u>

No firm figures are available on the extent to which Canadian companies are achieving faster tool and die change times. Case study evidence suggests that most parts manufacturers are at least aware of the possibilities, and all assemblers reported that efforts to improve times were under way. Some parts manufacturers expressed frustration about the cost of reconfiguring machinery to make possible the dramatic set-up time improvements.

Impact On The Workforce

The main effect on the workforce of faster tool and die changes are the consequences for the job content of those directly involved in the set-up process. Part of the philosophy of quick tool and die change is rigourous attention to doing what can be done safely while the machine is operating in order to speed changeover once it has stopped. Machine operators may be required to undertake tasks while the machine is operating, tasks that are usually done by the set-up man after the machine is stopped. Stress can also be created by pressure to achieve faster set-up times if this is not accompanied by adequate assistance to achieve those times.

HARD TECHNOLOGY

Hard technology refers to the physical plant, machinery and equipment used in the production process. The significant and widely publicized development in this area in the last ten years has been the advent of programmable automation -- equipment that can be reprogrammed to do different kinds of tasks without the need for substantial retooling.

The flexibility of this kind of equipment in turn gives manufacturers new flexibility with production runs and product quality. The gains are analogous to those from quick tool and die changes. Changeover times of a wide range of equipment and processes have been reduced or even eliminated. In combination with the soft technologies, hard technologies offer significant opportunites to enhance productivity and quality to those able to take advantage of the possibilities.

PROGRAMMABLE AUTOMATION

Automation -- even programmable automation -- is not a phenomenon associated only with computers. The metal-working industry has been using numerical control (NC)

machines since the 1950s. These devices work (e.g. cut, grind, drill) metal automatically and are programmable, but they receive their instructions via a paper or plastic tape, which has to be recreated if any of the instructions change.

The arrival of computers on the shop floor has changed the range of processes that lend themselves to programmable automation and the ease with which reprogramming can occur. Computers have also permitted communication between machines, and between machines and management, in ways never before possible.

Introduced in the 1950s, NC machines were an advancement on manual machine tools, on which all motions required to produce a given part were determined by the operator. Manual machine tools are cost-effective when the number of units produced is small, but the advantage in programming a machine to do repetitive cuts increases with the number of units.

Computerized NC (CNC) machines were introduced during the 1970s as an advancement on NC technology. Using microprocessor technology, CNC machines store instructions electronically, without the need for a paper or plastic tape. One advantage of CNC machines is fewer problems in delivering the instructions to the motors controlling tool movement. In addition, CNC machines are often capable of providing continuous feedback to the operator about the status of the machining process. The most sophisticated devices are capable of alerting the operator to tool wear or unusual vibration.

Programmable controllers (PCs) are small, dedicated, reprogrammable computers used to control and monitor a production process. The electronics behind CNC machines in fact are an example of a PC technology application.

PCs are used in a great variety of production processes. In plants with assembly lines, they can be used to control the movement of the line with the precision required to allow, for example, the use of robots. PCs are also used to control such variables as timing, temperature, pressure and volume in a host of processes, including casting, stamping, molding, welding, painting and baking. As well, PCs can be used in inspection,

such as the automated or semi-automated checking of parts against specifications, with the results communicated, in some cases to a central computer.

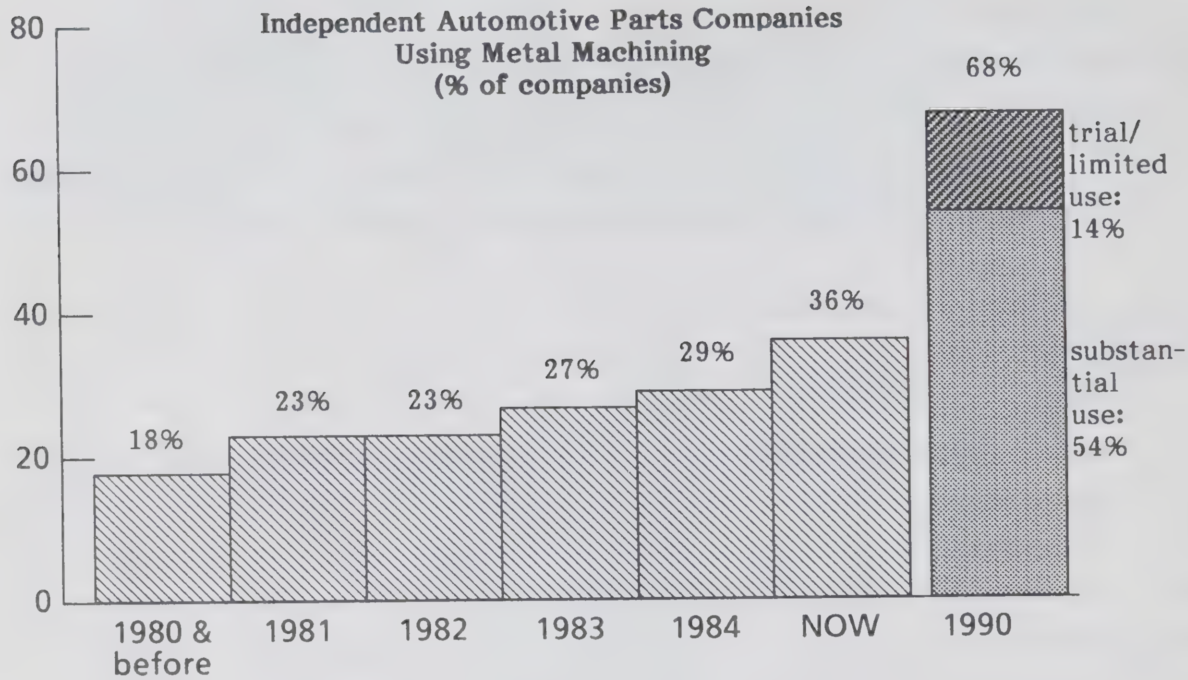
It should be clear that programmable controllers can be simple or highly sophisticated. For example, temperature control in paint baking ovens is relatively straightforward. On the other hand, the rubber intrusion machines at Waterville Cellular's operations in Quebec are considerably more complex, with a number of key variables being simultaneously monitored and controlled electronically.

Rate of
Adoption

The metal-working industry has by no means switched entirely to CNC or NC technology. Some U.S. estimates are that as much as half or more of all metal parts are still made on manual machine tools. In Canada the Task Force survey of the automotive parts industry found that among those companies engaged in metal machining, 36% had introduced CNC technology. The rate of introduction has been steady, and 68% of respondents anticipate using the technology by 1990 (see Figure 3.2).

Figure 3.2

CNC Introduction*



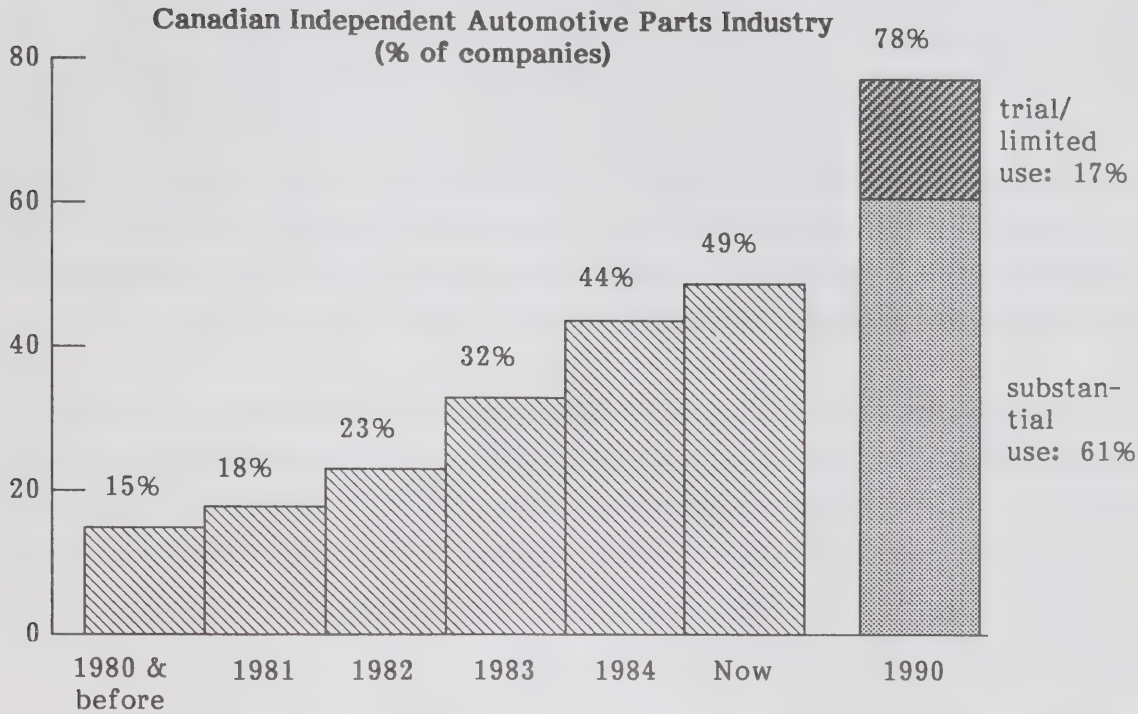
* By auto parts survey companies indicating metal machining as a process used.

Source: Task Force survey of the Canadian independent automotive parts industry

Programmable controllers have been much more widely adopted, with 49% of survey respondents indicating they use the technology. As Figure 3.3 shows, fully 78% of survey respondents anticipate using PCs by 1990. PC use is even more substantial in the operations of the automotive assemblers. Ford alone told the Task Force that it had over 700 of these devices installed in its Canadian plants. Chrysler reported 145 PCs in use in Canada. Among the smaller assemblers, Mack Canada reported 50 PCs in use.

Figure 3.3

PC Introduction



Source: Task Force survey of the Canadian independent automotive parts industry.

Impact On The Workforce

The impact on the workforce of programmable automation is far from straightforward. In the case of CNC machines, the addition of computer technology to a metal-working machine increases the operator's productivity and displaces other workers to the extent that productivity rises. The extent to which productivity increases varies from job to job, depending on the nature and number of operations required. The operator himself may or may not be displaced; Japanese manufacturers have experimented with some unmanned applications, with varying degrees of success so far. As well, the skills required of any given worker may or may not increase. Certainly for some, additional skills such as programming are required. For others, such

as those monitoring the machine without actually intervening in its operation, the level of skills required seems to decrease.

In the case of programmable controllers, the range of applications is so great as to make any simple statement about the effects on the workforce impossible. In some cases, job displacement can be shown, such as in the automatic control of processes previously monitored manually. In other cases, the programmable controller is either replacing an electro-mechanical device -- so that employment reduction resulted from a previous generation of technology -- or the controller is controlling or monitoring something that was previously unrequired or uneconomic to control or monitor, such as precise line movement or detailed quality inspection.

One clear result of the arrival of programmable automation is increased demand for the skills of electricians and machine repairmen. The major vehicle assemblers are engaged in massive training programs to arm their skilled tradesmen with the knowledge required to operate, maintain and repair automated equipment. As discussed more fully in Chapter 6, in some cases more than 2,000 hours of retraining are necessary, even for those previously fully qualified for their work.

ROBOTICS

More than any other kind of manufacturing equipment, robots have caught the imagination of the public as the symbol of the future shape of the workplace. Fanciful media reports predicted that hundreds of thousands of robots would displace millions of workers during the 1980s. According to these reports, one-person factories were imminent.

Such scenarios may indeed transpire, but the predictions have been wildly premature. Even the most optimistic industry analysts anticipate no more than 150,000 robots in place in North America by 1990, and some predict as few as 50,000 by that time.

Predicting the future of robots in automotive manufacturing is made all the more difficult by varying views on what constitutes a robot. For most people, any human-like manipulator might be considered a robot. The strict engineering definition, however, is that a robot is "a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or other specialized devices through variable programmed motions for the performance of a variety of tasks".

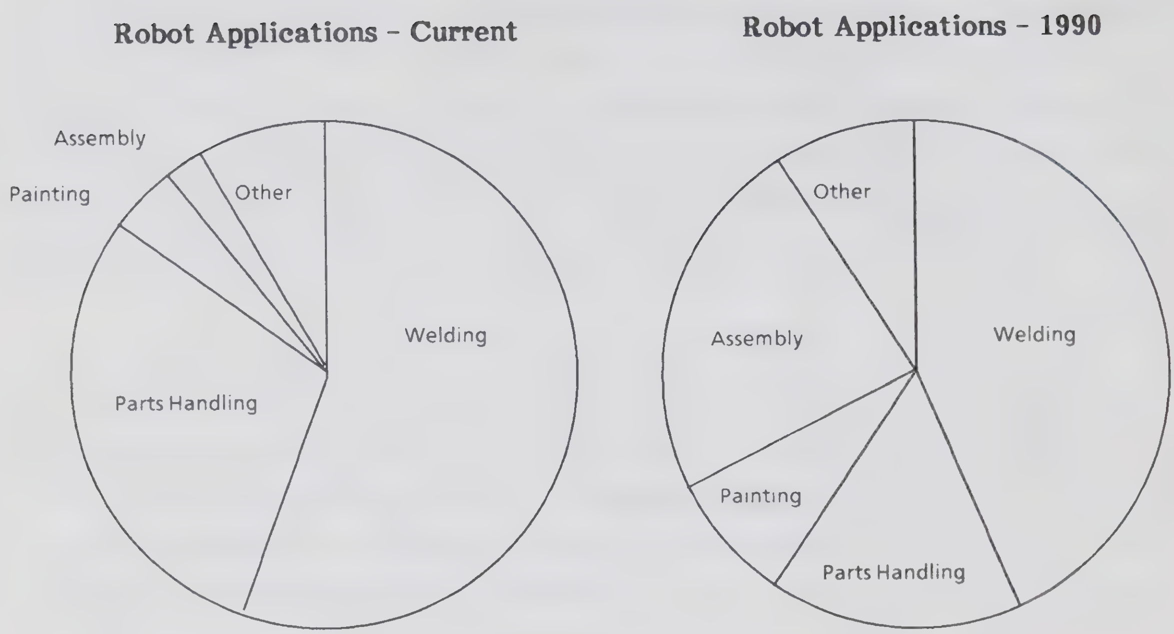
The key words are multifunctional and reprogrammable. A robot can perform different tasks on a single workpiece or repetitive tasks on a series of workpieces. It can also be reprogrammed to perform entirely new tasks. Many manipulators in the workplace are neither reprogrammable nor multifunctional and cannot be considered true robots.

Even narrowly defined, the Task Force did find robots to be performing a variety of tasks in automotive plants. The three main types of applications have been welding, painting, and machine loading and unloading. So far, assembly and inspection work by robots has been minimal, largely because most robots cannot sense their environments. Some robots are equipped with obstruction detectors to prevent damage to equipment or injuries to workers. However, robots that can sense and interpret their environments -- and change their activities accordingly -- are for the most part just emerging from the laboratory. Welding and painting robots, for example, are unable to "see" the exact position of the cars coming down the assembly lines. Sophisticated controllers must be used to ensure that vehicles arrive exactly where and when the robot is programmed to commence work.

General Motors provided the Task Force with a breakdown of where robots would be in use by 1990. As Figure 3.4 shows, the number of robots in assembly work is expected to increase to almost a quarter of all applications by 1990. Welding, however, will continue to be the largest single application for robots.

Figure 3.4

General Motors of Canada



Source: General Motors of Canada Ltd.

Rate of
Adoption

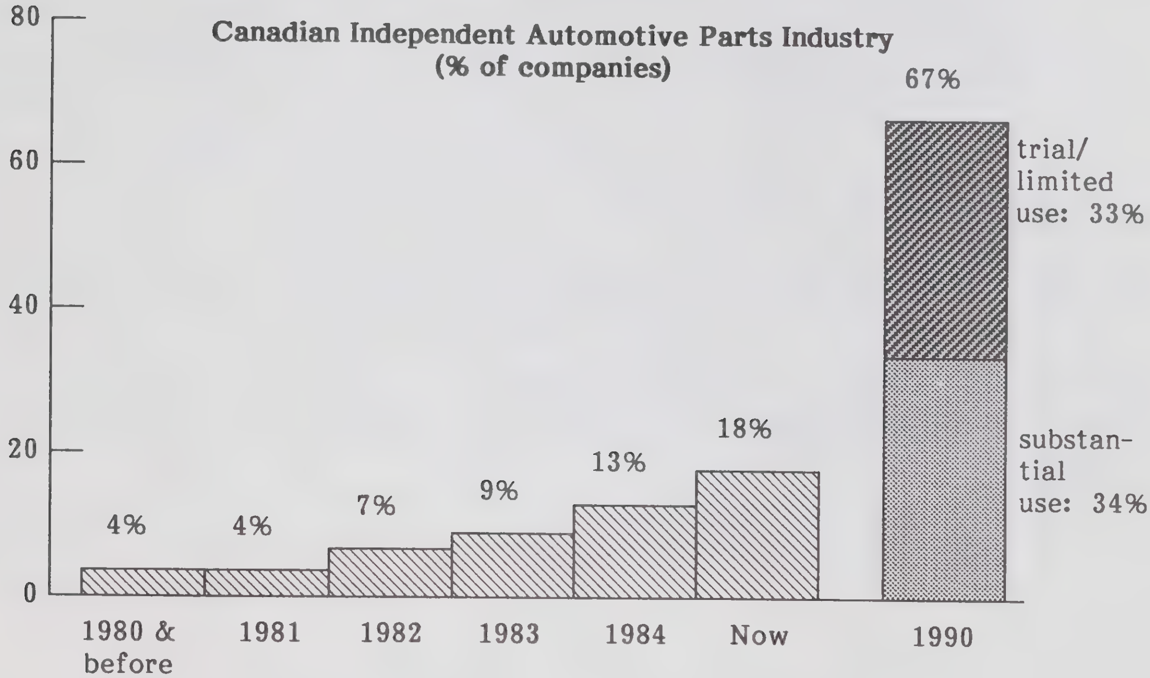
The automotive industry is a recognized leader in the adoption of robot technology, but cross-industry estimates as to the number of robots in use are sketchy at best. There is no complete statistical base in either Canada or the United States. A U.S. study by the Upjohn Institute estimated that no more than 14,000 robots would be in place in the United States by the end of 1984, of which some 4,000 would be in the automotive sector. In Canada, the Task Force found that there are about 600 robots in use in the auto industry (see Figure 3.5). Considered in the context of 800,000 American and 125,000 Canadian auto workers, these figures are small. As the parts

industry survey data indicate, the arrival of robots in the workplace has been steady through the 1980s and is expected to continue to 1990. Altogether, some 2,100 robots are expected to be installed by 1990 (see Table 3.2).

Figure 3.5

Robot Introduction

Canadian Independent Automotive Parts Industry
(% of companies)



Source: Task Force survey of the Canadian independent automotive parts industry.

Discovering how best to use robots has involved a complex learning process. Particularly given the need for structured environments, it has not been possible to drop robots into the middle of production lines without considerable planning and follow-up. As companies have gained experience, however, they have found it easier to increase the pace at which they can successfully add robots to their production processes.

The increasing sophistication of robots at any given cost, together with greater industry expertise, is having positive effects on the pace of robot introduction. Technical problems were a feature of many early applications. Both the major

Table 3.2
Robot Population – Canadian Automotive Industry

	Current	1990 Anticipated
Car & truck assemblers	476	1,842
Parts manufacturing survey respondents	124	248
	600	2,090

Source: Based on survey data and case study results

assemblers and automotive parts manufacturers can point to applications that, initially at least, failed miserably. We found that most problems related to the inability of the robot to achieve quality or reliability requirements. As confidence increases that these problems have been worked out, companies are increasingly attracted to the possibilities for robot use.

Table 3.3
Current Robot Applications
Canadian Automotive Industry Examples

Welding:	. Spot welding of auto bodies . Arc welding of armoured vehicle bodies
Painting:	. Painting of auto bodies
Machine Loading/Unloading:	. Removal of shot from casting machine . Loading of stamping press
Material Handling:	. Line transfer in transmission plant
Assembly/Other:	. Application of sealant to windshield . Soldering of circuit board

Source: Task Force Research

Strategies for introducing robots differ widely across the automotive industry. Substantial resources at Chrysler's Windsor, Ontario, mini-van assembly plant have been committed to robot use. Some 125 robots are being used in a variety of applications. Most spot welding and interior painting applications are handled by robots.

The interior painting application is a good example of the use of robots to remove workers from an unpleasant environment and a task where consistent results are essential. In a traditional paint shop workers spend hours on end to get an absolutely even coating of a toxic substance onto the many exposed surfaces of the vehicle. In the winter the paint shop is tolerably warm; in summer, temperatures crawl into the thirties. Introducing robots into this environment at Chrysler has had a double payoff. Workers have been freed from an undesirable work situation, while at the same time the robots' consistent work has assured a high level of quality.

TRW Canada is an example of a company that has opted for a slower-paced strategy. TRW engineers have concentrated on limited, off the shelf applications of robots to the production process to achieve maximum productivity and quality gains with minimal workplace disruption. As more is learned about successful techniques, more robots are being added gradually.

Impact On The Workforce

Clearly robots have the potential to improve the quality of the work environment by removing workers from unpleasant or dull and repetitive jobs. However, robots and programmable automation in general can also contribute to an unpleasant environment by virtue of the work that remains. It may be more satisfying to work as a spot welder, despite the conditions, than it is to tend a spot welding machine. As well, robots are diligently consistent not only with respect to the quality but also the pace of work. Workers feeding work into robotic applications can find themselves with no freedom to control their own pace of work. This puts an end to practices like "banking". With banking, a worker can vary the pace of work, provided a minimum or set amount of work is accomplished over a given period.

As more robots are introduced to the industry, questions of job displacement will become more important. On the basis of a two-shift operation, we estimate that the average robot displaces 1.8 workers: two workers are displaced directly but there is some gain in the hiring of personnel to service the machines.

In Canada, robots have probably "displaced" just over 1,000 workers -- 600 robots times 1.8 workers per robot. This has occurred in the context of a recovering industry, however, so the use of robots has decreased hiring needs rather than caused layoffs. The Task Force estimates that there could be as many as 2,100 robots in place by 1990, by which point the displacement effect would be 3,800 workers, equivalent to the hourly workforce at a plant assembling 250,000 vehicles per year.

COMPUTER-ASSISTED DESIGN

New methods of production have been the focus of this chapter. While not strictly a production technology, the application of computers to design and engineering is redefining the nature of the link between engineers and the production process.

Computer-aided design (CAD) systems replace pen and paper drawing boards with computer terminals. Using keyboards, light pens and other computer tools, engineers and draftsmen are able to do detailed designs much more quickly than previously possible. CAD systems are quicker not only because original input ("drawing") time is faster but also because changes are incorporated easily into the drawing without the need to redraw. New designs can be created by recalling previous designs from the computer's memory and amending them as required.

Early CAD technology is being enhanced in two significant ways. The first, referred to as computer-assisted engineering (CAE), allows the engineer to "test" designs even before prototype products are built. Circuit tests are run on "circuit boards" as designed. More advanced systems can test proposed structures for their load capabilities and other behavioural characteristics. These systems are having a tremendous impact on the speed with which designs can be created and on the number of

possible designs that can be considered and tested before final designs are decided upon or prototypes built.

The second enhancement to CAD is often referred to as CAD/CAM, -- computer-assisted design/computer-assisted manufacturing. With CAD/CAM, design or process changes are keyed in by engineers on CAD systems and communicated electronically to the CNC, robotic or other electronic devices manufacturing the product. Production is then altered as required.

Rate Of Adoption

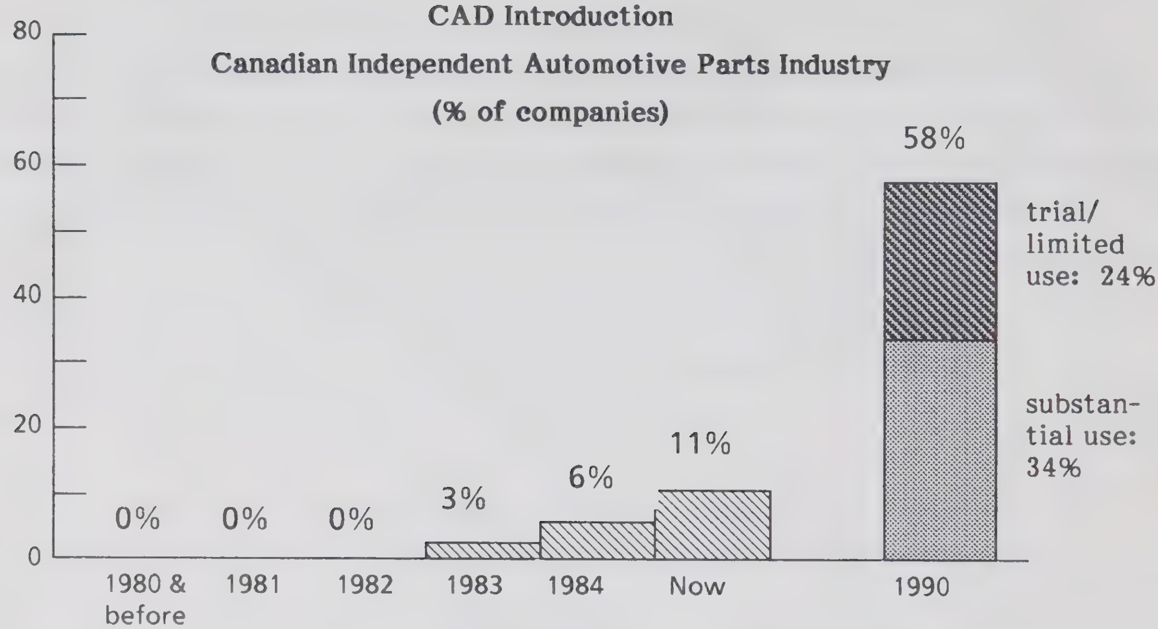
CAD systems in the Canadian automotive industry have a greater presence in the parts manufacturing sector than among assemblers. The assemblers are making extensive use of CAD and CAE, but virtually all product design work is carried out in the United States. General Motors Canada reported 31 workstations in use in Canada however, and Ford Canada is using CAD technology at certain of its Canadian parts plants.

In the Canadian parts sector, CAD is making inroads as system costs fall and system capabilities increase. Microcomputer technology appears to be a factor here, particularly among the smaller firms. Microcomputer-based systems can now be purchased for under $25,000 with the same power as the minicomputer systems of only a few years ago. Very basic software is available for $2,000 or less.

In the parts manufacturers survey, 11% of respondents reported they were using CAD. As Figure 3.6 shows, all have started within the last three years. Use of CAD is concentrated among the larger parts manufacturers. Whereas 24% of companies with sales over $20 million reported using CAD, usage was only 5% among companies with sales less than $20 million.

Experience thus far with CAD has apparently been generally positive. The parts manufacturers we interviewed all reported that the introduction of CAD had had

Figure 3.6
CAD Introduction
Canadian Independent Automotive Parts Industry
(% of companies)



Source: Task Force survey of the Canadian independent automotive parts industry.

significant effects on productivity in design work. Several also spoke about how an in-house CAD capability is enhancing their competitiveness. An electronic components manufacturer told the Task Force how links with an assembler's Detroit-based engineers had improved as a result of their CAD work. The engineers were sufficiently impressed with the manufacturer's library of designs that they asked that a copy of the library be transferred to their own system to allow instant access to the designs. Another manufacturer advised us that its CAE capabilities in die design are allowing it to bid on casting contracts using specifications that exceed the requirements laid down by the assemblers.

The forecast rate of adoption to 1990 -- with 58% of parts manufacturers expecting to be using CAD and a similar number expecting to use CAE -- may initially appear high. The experience of users suggests, however, that there may be strong competitive pressures to introduce the technology. This would be consistent with the overall trend towards closer links between assemblers and their parts suppliers.

Impact On The Workforce

CAD itself has had little effect on the workforce at large. Among assemblers, CAD has decreased the need for draftspeople; however, this has mainly affected American-based design work. Among Canadian parts manufacturers, the trend on the part of assemblers to outsource design work seems to have cancelled out any reduction in staffing requirements due to the technology.

The real impact on the workforce will occur as the enhancements on CAD become increasing prevalent. Advanced communications technologies, as discussed in the next section, could alter the shape of the workplace fundamentally in the long run -- affecting staffing levels, job content and the very nature of the relationship between management, workers and equipment.

EMERGING TECHNOLOGIES

From the microchip controlling fuel injection, braking and other vehicle functions to the mainframe controlling assembly line movement, computers are manipulating and responding to data in an ever growing variety of ways. Computers are increasingly being given the capability to communicate with each other, to interpret their environments and to act on the information received. Companies of all sizes are moving quickly to capitalize on the possiblities. It is in this emerging area that programmable automation may have its greatest effect on the workplace.

Advanced communications are already affecting all facets of the production process. Furthest along are the computer links between companies. Motor vehicle manufacturers have arranged computer links with an increasing number of their suppliers. Among those parts manufacturers with more than half of their production going to the assemblers, 54% reported having computer links in place. Four out of five expect these links to be in place by the end of 1987. Among parts companies with

annual sales volumes of $50 million or more, 80% already had computer links in place and all expect to be linked by the end of 1987.

Currently these links are primarily affecting administrative functions rather than the actual production process itself. For example, the links allow the motor vehicle manufacturer to check inventory levels and allow automated notice of payment for goods received. The same communications network also allows the vehicle manufacturer's computer to instruct the computer at the vehicle manufacturer's bank to credit the account of the parts manufacturer.

Clerical staff are the workers most affected by these computer links between companies. Some staff continues to be required for residual paper handling functions, and for dealing with customers and suppliers who are not linked by computer. Nonetheless, the automation of order entry, billing and certain customer inquiry functions does result in a reduced need for clerical staff performing those jobs.

Brief reference has already been made to CAD/CAM technology, whereby computer-aided design work is communicated directly to manufacturing devices on the shop floor. A modification to, for example, the design of a metal rod can be communicated to the CNC machine producing that rod. From that moment on, the rods being produced conform to the new design, with no operator intervention. Note that the design change could be communicated to the machine by telephone from a different location, for example, from the engineering department at a company's head office. What might have previously taken days can take place in hours - or even minutes.

This is an example of direct communication between engineers and production machinery. Current industry installations are limited in scope, however, the technology is rapidly developing as protocols are established and the general body of experience is increased. While one in twenty-five parts manufacturers reported CAD/CAM in place now, the figure will be one in five by 1987. By that time, at least three of the major Canadian vehicle manufacturers will also have some CAD/CAM technology in place.

Communication can also take place between machines. For example, the spot welding robots at the Chrysler mini-van plant in Windsor are linked; if one robot shuts

down, other robots automatically compensate by taking over that robot's work. If for any reason all welds cannot be completed, the operators are advised of which welds were missed.

This application of programmable technology is a limited example of what is often referred to as a Flexible Manufacturing System (FMS). By linking together a series of programmable devices -- typically CNCs but also PCs and/or robots -- an entire product is manufactured or a set of manufacturing steps is completed with little or no human intervention. What distinguishes FMS technology from other highly automated production is its flexibility. With the most sophisticated FMSs, a range of products can be produced sequentially, or the equipment can be programmed to produce quite different products in job lots with a minimum of retooling.

The Task Force found no successful examples of state-of-the-art flexible manufacturing systems in use in the Canadian automotive industry. One manufacturer had the equipment for an FMS application, but the project was on hold because the part that was to have been produced was never brought to market.

A study published in 1985 by the Office of Technology Assessment in Washington, D.C. estimated that in all of the United States only 25 to 30 full FMS systems were in place. Other studies have found the success rate of FMS-type projects to be low -- 30% in one study. It is clear that flexible manufacturing -- the source of one-person factory stories -- will have to be substantially improved upon before its use will become common place.

Bar coding is yet another aspect of advanced communications technologies. Similar to the universal product symbols now found on most grocery items, bar coding facilitates inventory control. By reading the bar codes on newly arrived shipments of parts, computers can enter information on the shipments rapidly and accurately in the inventory records system. Should the shipment prove defective, the computer technology behind bar coding allows for rapid tracing of other potentially defective parts from the same supplier job lots. Bar coding is rapidly being introduced in the automotive industry as part of the move to automate inventory control and materials handling.

Finally, not only are computers increasingly able to communicate with, interpret and react to their environments, but also programmable automation is resulting in machines able to monitor themselves. Equipment able to perform extensive self-diagnostics on the shop floor -- that is, able to provide precise information to the operator on the nature of a wide variety of mechanical or electronic failures -- is rare indeed. This is however another area of research and development which could over the longer term have a significant impact on the nature of the workforce required to monitor and maintain equipment.

Impact
On The
Workforce

The impact on the workforce of the emerging technologies discussed in this section of the chapter have so far been minimal. However, the fantastic sophistication of programming required to drive computer-integrated manufacturing and self-diagnostics is now emerging from the laboratories. Complicated communication technologies will become increasingly routine.

The view was offered at the outset that while product technologies were readily copied, production technologies could be copied only with concerted effort. More generally though production technologies can be adopted only with concerted effort, whether or not they are being copied from another manufacturer's application. The new technologies cannot be dropped as discrete chunks into the production system but require in many cases a rethinking of the system and the way its component parts relate to each other.

As with the other technologies discussed in this chapter, the relative speed with which the emerging technologies will diffuse into the industry will be eased by virtue of the resources required for system rethinking and the associated capital costs of any resulting changes to the production process. But while technological change in the industry will continue to be evolutionary, it should be clearly understood that the snapshot this chapter has offered to 1990 in no way represents an end-point and the absolute pace of change will continue to be high. For all these reasons, the need for the workforce to be prepared for and responsive to a changing work environment will remain high.

CHAPTER 4

EMERGING TRENDS IN WORKFORCE MANAGEMENT

A combination of factors has highlighted, to North American management, the importance of the workforce to corporate survival. This recognition has led to a number of changes in workforce management and to the initiation of experiments that have dramatically altered the organization of work, worker responsibility, and compensation systems.

In some cases this has led to better labour-management relations and to improvements in worker output and quality, but in other cases, underlying competitive pressures have increased tensions between management and the workforce. In general, these trends are in their infancy, and it is still too early to tell whether the changes that are occurring will remain in effect, whether they will continue but in quite different forms, or whether they will be reversed.

The degree of experimentation and the level of change that has occurred to date, though still limited in both Canada and the United States, has gone further in the United States. The economic pressures contributing to these changes have not been as great in Canada as in the U.S., and the Canadian union has been less convinced of the benefits of many of the proposed changes. Nevertheless, the Canadian UAW has been prepared to discuss, experiment with, and implement changes that do not compromise the interests of the workforce.

In analyzing such trends it is important to keep the starting point in perspective: although the traditional system of labour relations and workforce management is the focus of many of these changes, it is a system that has served the Canadian automotive industry exceptionally well, and the industry's record over the past three decades has

been impressive. As the Federal Task Force on the Canadian automotive industry stated:

> The auto industry creates more value-added per worker than the average in Canadian manufacturing, and the industry has historically realized productivity improvements that rank it at or near the top of Canadian industry. Recent major investments, including manufacturing plant and process improvements such as the spread of robotics, will accelerate the rate of productivity growth.
>
> The Canadian workforce is highly skilled. Productivity, manufacturing quality, labour costs and absenteeism in Canadian automotive plants compare favourably with conditions in automotive plants in the United States, Europe and Australia.[1]

Nevertheless, pressures for continued improvements and new directions in workforce management are accelerating.

PRESSURES TO CHANGE WORKFORCE MANAGEMENT

Several factors have combined to change expectations about the contribution of the workforce to corporate competitiveness. The most fundamental factors were the strain of the recent recession and the intensified competition for market share. This competition emphasized the need to employ all inputs to their full potential and highlighted the fact that ignoring the existing skills and experience of the workforce and neglecting to develop broader skills and commitments among workers were a waste of valuable resources.

Other vital factors included the following:

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1. Report of the Federal Task Force on the Canadian Motor Vehicle and Automotive Parts Industries (1983), page x

- The competitive importance of product quality and the link between quality and a more satisfied workforce;
- Technological changes and their dependence on upgrading skills, the development of new skills, and greater worker responsibility;
- The reorganization of work in ways that put a premium on no interruptions in the process -- from workers or from other sources;
- Competitive pressures on cost and the desire of management to alleviate the resulting tensions by closer ties and communications with the workforce; and
- A prevailing sense on the part of management that valuable insights could be gained from the experiences of the Japanese auto companies.

Re-examination of the traditional model of workforce management began in the early 1970s, prompted by the growing dissatisfaction of young auto workers with boring, repetitive jobs and with the 'command and control' approach of management. A new generation of auto workers had higher expectations for their jobs and were not content with merely tightening bolts on an assembly line. A dramatic strike in the early 1970s at the newly opened, highly automated General Motors assembly plant in Lordstown, Ohio, became a symbol of worker alienation in the industry.

During the seventies, there were several notable efforts to reduce worker alienation and improve job satisfaction. The Scandinavian countries experimented with job enlargement -- increasing the number of assembly tasks assigned to each worker -- and with giving workers the chance to rotate from one job to the next within their work group. Volvo, at a new plant in Kalmar, Sweden, went so far as to redesign the assembly line, developing motorized carriers that would move from one work station to the next, stopping for 30 to 45 minutes while each worker team carried out its responsibilities. These innovations resulted in improved job satisfaction and productivity gains.

North American industry set out on a different course. Quality of worklife programs were established under various names describing new expectations for the

management of the workforce. Most of these initial efforts were not adequately supported with a fundamental commitment to change and as a result some were successful and some were not. However, lessons gained from the experience combined with intensified competition have led over time to a better appreciation of the role of the workforce in achieving productivity and quality gains and just as significantly, how that role can be created and sustained.

THE JAPANESE MODEL

After the dramatic penetration of the North American auto market by the Japanese companies in the late 1970s, the Japanese approach to automobile production came under close scrutiny.

Although factors such as exchange rates, the tax system, technology and plant organization were fundamental to the success of the Japanese companies, a growing consensus emerged that a key part of the Japanese success was their approach to managing the workforce.

Whatever its advantages from the perspective of production priorities, the Japanese model of workforce management was not embraced in its entirety in North America because certain features are incompatible with North American social norms. For example, female workers are generally excluded from unions and therefore lack wage and benefit parity with male workers. Other differences from North American worker and union priorities include different pay for the same work (pay being based on seniority), lower levels of leisure time by comparison with levels in other industrialized countries, weak pension plans and company-based rather than industry wide unions. The Japanese parts industry differs from its North American counterpart through its reliance on low wage, low benefit, no security cottage industry for a significant part of the supply base.

Nevertheless, the pressure to emulate Japanese workforce management techniques has been reinforced since Japanese companies began building production facilities in the

United States, starting with the Nissan truck plant in Smyrna, Tennessee, and Honda plant in Marysville, Ohio, and continuing in 1985 with the joint GM-Toyota plant in Fremont, California. These Japanese-owned or co-owned plants duplicate many features of the Japanese model of workforce management, while dropping some that are more culturally jarring, and have performed at productivity and quality levels that approach or match those achieved in Japan. The apparent success of these plants, staffed with American management and workers, has also contributed to an easing of the natural suspicions with which the Japanese model has been regarded.

FORGING THE NEW WORKFORCE MANAGEMENT REGIME

The Task Force has looked closely at what is taking place in North America. We have met managers and workers at a variety of facilities in Canada and the United States. We have also met with a number of leading experts on technological change and its effects, and we initiated several in-depth case studies of our own to ensure that we have a representative and balanced view of the initiatives and issues surrounding changes in workforce management today. What we have found is that there are differences in the approach to change emerging in Canada and the United States. The factors affecting the process and the ultimate directions of the new workforce management regime are examined in the following sections.

Points of Departure From The Traditional System

Intensified efforts have been under way in the motor vehicle and automotive parts industry over the last five years to find new ways to strengthen management and to capture more fully the potential contribution of the workforce. In some cases, such as Ford, change has been described in terms of participative management and employee involvement, and programs have been initiated fundamentally to transform the way the organization works. GM has undergone a comprehensive reorganization and has sought

change through a variety of actions across a diversity of locations. Chrysler, at its mini-van plant in Windsor, has combined worker commitment with advanced manufacturing systems to stand at the forefront in North American production. Automotive parts manufacturers have worked to advance their capabilities as well, some companies having trained their entire workforces in problem-solving approaches and worked to put meaningful new responsibilities into the workplace.

The innovative experiments at North American-owned automotive plants since 1980 in some cases have matched Japanese standards for quality and productivity. Plants have been saved from closing, new production processes have been discovered, many quality problems have been solved and there is often more dialogue between management and worker representatives. Other benefits ascribed to worker involvement are a more motivated workforce and better overall labour relations.

The process of North American innovation and adaption has also begun to confirm what the elements of a new workforce management approach are likely to be and the areas where change is being initiated: workplace environment, management approach and the respective roles of management and the union. At the same time it would be wrong to characterize the current enthusiasm surrounding these changes as a template of the workforce management regime of the future. What the Task Force has seen is support for positive change, a range of ideas about what the nature of changes should be, a series of experiments where changes have been tested and a mixed record of success. The industry is in the middle of a dynamic period of fundamental change, and, although the agenda has become clearer, it is still too soon to know with certainty what the outcome will be. Above all else, however, the need for change is recognized.

The quality of the Canadian workforce has never been in question. Levels of education on entry continue to rise, and training is escalating to enhance skills and lay the basis for greater contributions from workers. As well, collective bargaining has achieved good wages and benefits compared to most workers. Creative energies in the industry are now being invested in finding ways to capitalize even further on the strength of the workforce and preserve the attractive financial returns to workers that have been part of the industry.

The Nature
Of Change

Fundamental changes are taking place now -- and others are being considered -- that have significant effects on conditions of employment. Worker involvement requires a reorganization of the work process that often gives workers broader responsibilities and more discretion in their daily activities. At GM's Fiero plant[2], for example, each production worker is responsible for monitoring the quality of all parts passing -- there are no quality inspectors.

As production jobs are broadened, new technology is introduced, and greater worker flexibility is sought, some reductions in the number of job classifications result. The expectation that over the next ten years the industry will increasingly move away from the assembly-line model of production to a workstation model will intensify interest in rethinking the occupational structure of the workforce.

At the Chrysler Windsor Van Plant management and labour have agreed, as a result of the recent negotiations, to review job classifications. At GM's Fiero plant, there are 34 job classes -- down from over 200 at the Pontiac plant that preceded it. Other ventures, such as GM's Saturn Project, are planning even further reductions in the number of classes of production and skilled trades workers.

In the U.S., new approaches to compensation and employment security are also being introduced in support of worker involvement schemes. At GM's new Buick City complex workers' pay increases when they master an increasing number of skills needed

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2. In considering the Fiero Plant, it should be noted that this facility has unique characteristics: the plant line speed is about half that in other plants and the product itself is a specialty vehicle sold into a limited market

by the team.[3] Workers with multiple skills contribute to increased job flexibility and an expanded potential for the contribution of each worker. The shift towards job flexibility has led to a new focus on employment security -- as opposed to job security -- in recent contract negotiations between the UAW in the U.S. and the automotive companies. Typically, workers who have reached a certain seniority level are guaranteed employment somewhere within the company until their retirement, if their current job is eliminated due to technological change or outsourcing. Extensive retraining and placement programs have been established to prepare workers for a shift to new jobs. The union agreement with GM-Toyota requires that, under certain circumstances, before any hourly employees are laid off, the salaries of management staff be cut and any subcontracted work be returned to the plant.

Equally important changes are taking place in management philosophy and approach. As more responsibilities are integrated into production jobs, there is a vastly different requirement for management and supervision. Motor vehicle and automotive parts manufactures have reduced -- in some cases, very dramatically -- the size of the white collar workforce.

As well, more emphasis is being placed on participative management. Supervisors are now expected to be facilitators and coordinators, and more and more managers are being asked to unlearn a lifetime's accumulated knowledge of accepted ways of being the boss and to become leaders and coaches -- taking on a role that heretofore has been both unworkable and out of character with the people working their way up in the system. Ford now tests new supervisory personnel for human relations skills before hiring them and provides training in participative management to all managers.

But the industry has found that changing the management approach is not like throwing a switch from "control" to "involvement". Experience and attitudes acquired over a lifetime must be unlearned. New models of management must show continuing

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3. Workers may, if they prefer, opt out of the "pay-for-knowledge", job cluster system in favour of a fixed classification. In this case, they are assigned to one specific job, must be proficient in one other job, and are paid the base, 2-job pay-for-knowledge rate

patterns of success. At this time, the process of transition is only part way along, and the Task Force sees the emergence of a consistent and significantly different management approach as a key factor that will ultimately determine the form and pace at which a new workforce management regime will evolve.

Finally, the changes taking place in the workplace are also having a significant bearing on the roles of workers and the union. Workers are now members of problem-solving groups in a number of plants and meet on a regular basis to improve the production process and often to improve the quality of the product. Such group activities are delivering impressive results.

One of the most publicized successes in North America has been "The Saving of Engine Plant 2" at Ford Windsor operations.[4] Faced with the likelihood of a permanent shutdown, an employee involvement group from the stampings area took on the challenge of improving operations and demonstrating the viability of the facility. Ford gave them a year to do so, with the condition that plant profitability and productivity had to increase every quarter. Within a year costs were cut by 60%, scrap was reduced to 2%, and productivity rose by 30%. What had been a $1.1 million annual operating loss was turned into a $500,000 profit. Moreover, the employee involvement group was able to use its successes to bring additional business to the plant and even saw the return of large engine production in the plant.

Throughout the industry there are impressive success stories about the contributions the workforce has made to quality and productivity through their involvement in their jobs and their participation in solving problems that bear on their ability to do their jobs even better. Ford Canada has made a committed workforce a feature in its "Quality Is Job 1" television commercials. In many companies, employees are working with suppliers to help solve quality problems before they arrive on the shop

4. Title of a May 1984 Readers' Digest article.

floor. Employees are also making the difference in adapting new manufacturing technologies to effective use in the workforce. In fact, without the essential involvement of workers these technologies frequently fail to meet performance expectations.

The industry has had less experience integrating worker participation into the management structure of plants. Where experiments have attempted to extend the group structure used successfully by workers on the plant floor into the plant management structure, a continuing need has been found to delineate the respective roles of management and the union. The General Motors Fiero plant represents one of the first attempts in the North American automotive industry to work these roles out and at the same time commit fully to worker involvement at all levels in the plant. The lines delineating responsibilities have been drawn around four types of decisions: those that affect the group involved, those that bear not only the interests of the group but affect others, those that are the purview of management, and those that are covered by the collective bargaining agreement. Local or national bargaining issues are not discussed in group meetings, although union representatives may be invited to discuss or explain contractual issues. But, as we noted earlier, Fiero is by no means the industry norm, and its particular approach has to date not been widely replicated in other manufacturing facilities.

Nonetheless, this experience and others have led to some changes in management expectations of the involvement of the union in the management regime. The areas management has begun to focus on include:

- New plant start-ups and the design of the management system, the organization of work, the classification of the jobs and the approach to consultation and workforce management;

- Designing and carrying out a wide range of training such as orientation courses, retraining, and occupation health and safety;

- Some worker and union participation in the design and monitoring of technological change in the workplace; and

- In the U.S., changes in compensation arrangements, such as pay based on multiple skills, profit sharing or bonuses based on plant performance and annual salaries; and in a few still isolated cases, the ongoing decision-making structure of the plant, including membership on the management committee and disclosure of plans, issues and operating results.

It is far too early to describe these developments as standard practices or to know how they will finally take root as part of the ongoing labour relations agenda. However the very process of addressing these issues is leading to the development of differing approaches to workforce management in Canada and the United States.

The Canadian Course

Directions in workforce management in North America have traditionally been set through the collective bargaining process. The UAW in Canada has been very much a part of this course and remains committed to it today. From the standpoint of the Canadian union this has meant subscribing to the objective of supporting the development of a healthy and productive Canadian industry. This objective was set out clearly in the Federal Task Force on the Canadian Motor Vehicle and Automotive Parts Industries where the United Auto Workers of Canada stated

> "We will continue to represent workers in their concerns about income and job security and their need for valued employment. Within these parameters, the Union will continue to support the introduction of new technology, the steady improvement of the quality of the product, and the social and economic importance of producing good products at prices consumers can afford."[5]

5. Report of the Federal Task Force on the Canadian Motor Vehicle and Automotive Parts Industries (1983), page 123.

Moreover, the UAW-Canada has participated actively in the pursuit of these ends. As we indicate in detail in the next chapter, whether technological change involves robots, CAD/CAM, programmable controllers or statistical process control, workers and managers are actively working together to introduce new technologies. Rather than meeting resistance from the union, technological change in Canada has often been steered through joint union-management technological change committees in the plants. Effective consultation between labour and management is also part of the considerable training that is taking place to impart new skills in group problem-solving, statistical process control and participative management approaches.

Reinforcing the processes of negotiation and cooperation at the operating level in the automotive industry has had active industry and labour involvement at the strategic policy level in Canada . This Task Force is one example. The 1983 Task Force on the Canadian Motor Vehicle and Automotive Parts Industries was another example that not only set the standard for consultation in Canada but is also highly regarded in the United States, Europe and Japan. The recent Ontario Study on Employment and New Technology is another example of the UAW-Canada, other unions, and industrial leaders coming together to reach common findings, despite their sometimes divergent interests. Such forums should not be taken for granted. Consultation among business, labour and government is a unique feature of the automotive industry in Canada and an important part of the new participative regime that is evolving in this country.

While the commitments made and the processes in place all give meaning to the efforts of labour and management to achieve new levels of productivity and quality, the real measure of success has been in the performance of the Canadian industry. In terms of absenteeism, quality, productivity, and cost structures, the performance of Canadian plants generally ranks in the top categories in North America. The Canadian industry is recognized for the quality of its work and its workforce. It also continues to make substantial productivity gains that both the union and management expect to be in the range of 4 to 5% each year.

The structure and recent history of the Canadian industry have had a dominant influence on the approach to workforce management, its development and its future course. While the downturn in the North American automotive industry brought severe

layoffs in both Canada and the United States, the Canadian industry was, relatively, not hit as hard. Moreover employment in Canada has reached an all-time high this year while in the United States, an estimated 5 % of the workforce is still on indefinite layoff and has no prospects of returning to the industry. Although there are the beginnings of some Japanese automotive investment in Canada at this time and indications of substantially more, the United States industry already has producing plants in Tennessee, Ohio and California. The Japanese approach to workforce management is part of the automotive scene in the United States and is growing rapidly. Thus the Canadian automotive industry has been characterized by a different structure and environment over the last five years - a difference that has never before existed in the postwar North American industry.

These differences in structure and environment are also beginning to be reflected in differences between Canada and the United States in the development of an approach to management.

<u>Canada is following an evolutionary course</u>. The changes taking place in the workplace and affecting the workforce are being dealt with as they are encountered, either through the collective bargaining process or through ongoing union-management consultation. Most of the changes have been incremental; traditional workforce management practices are gradually replaced by new practices intended to encourage greater worker involvement. In most cases, change has taken place in existing facilities within the existing labour-management structure, although a few greenfield start-ups -- such as the new AMC-Renault facility -- are coming up for negotiations in the near future and, in these cases, opportunities may exist for new approaches.

The UAW-Canada is also committed to supporting policies and practices that affect the industry and that are not specific to any one plant or situation. As part of this philosophy, the Canadian union has resisted labour-management regimes that are unique to a plant or company. In Canada, unionism transcends straight company-related interests and is part of the social fabric of the country. This same spirit of unionism eschews any attempts to see the interests of the workers fully satisfied by the workforce management system in any one enterprise.

The American Course

In the United States the workforce management approach is being forged through a series of diverse initiatives. New plant start-ups or complete renovations of existing plants are being used systematically to introduce new systems of management and new models of worker involvement. Plant expansions are likewise providing opportunities. Ford's incorporation of across-the-board team building as an integral part of the second shift addition at its Norfolk, Virginia truck plant is an example of this potential. Permanent plant closings and lay-offs have spurred management and the workforce to look to innovative organizational approaches to secure new products for plants that face closing. The Fiero plant is a case in point. Faced with the prospect of a plant closing, a group of managers, workers and union officials met for six months to prepare a bid to build the new P-car at the old plant. Once their bid was successful, managers and workers have carried the same spirit of cooperation into their ongoing system of workforce management. During the period when old facilities were gutted and new facilities put in place, joint union-management committees oversaw every aspect of the rebuilding. There were also committees on the purchase and installation of new technology, the restructuring of jobs, and the training of the workforce. These committees operated by consensus -- any member could veto certain decisions. Out of these difficult, mutual efforts has come an ongoing role for the union in decision-making. At Fiero, the chairman of the shop committee sits on the management committee and is privy to all details of upcoming strategic plans.

The new Chrysler-Mitsubishi joint venture, NUMMI (the GM-Toyota joint venture), the GM Saturn project and the Ford Alpha project all represent other initiatives that could be signposts on the way to a new system of workforce management in the United States. The NUMMI plant is managed by Toyota personnel and includes a selected number of General Motors staff who are being trained in Toyota production techniques. The Chrysler-Mitsubishi venture has just been announced, but plans call for significant training of American workers in new production management skills as well as managerial leadership from Mitsubishi personnel located at the plant.

General Motors' Saturn Project represents a major north American attempt to go beyond the best Japanese, North American and European manufacturing management practices. A committee of 35 company officials and 64 union members worked together in secret for a year and one half to agree on all the critical aspects of the new organizations. Proposed new initiatives have been drawn from the best ideas across the automotive world. Innovative thinking has also been an imperative in the effort to design a workforce management approach that can achieve world competitive leadership in North America for small car production. Within the Saturn structure, fundamental changes are proposed in conditions of employment, management approach and the respective roles of management and the union.

Ford Motor Company's Alpha project - initiated in January 1985 - reflects that company's interest in maintaining small car manufacturing in North America, utilizing as prerequisites to success new concepts in design engineering, production management and employee relations. In pursuing such small car production in North America, the Alpha project contemplates joint participation by management and labour in planning a new small car concept through innovative approaches.

The American course in workforce management now seems to be charted by a series of diverse initiatives, each starting with a model and a commitment to putting that model in place whether it was designed through a joint venture arrangement or by an extensive labour-management committee exercise. Although some of the North American models such as Saturn exist only as concepts at this time, the popular attention they attract serves to signal the ongoing, low-key but nonetheless extremely significant developments occurring throughout the industry. Moreover, the apparent success of Nissan and Honda in the United States has given the industry added reasons to expect significant competitive returns from participative workforce approaches.

It is vital to re-emphasize, however, that all these changes and developments remain in their infancy, and their evaluation must await time and further experience with them.

Looking
Ahead

The future course of workforce management in Canada will be influenced by a number of factors, not the least of which is the relentless pressure of international competition. A crucial variable in the process of successful change at this time is the ultimate direction of meaningful worker involvement. To this point, worker involvement has had a spotty history. One estimate is that less than 10% of the motor vehicle and automotive parts manufacturers have meaningful worker involvement programs in place at this time. In some plants, worker participation has been introduced only to be subsequently rejected because of insufficient training or a lack of organizational support. In other organizations, cautious attitudes on the parts of management engendered resistance to change in traditional approaches. There has also been little encouragement from the union; the UAW in Canada at the national level has remained neutral on the worker involvement issue. Across the industry, although there have been notable successes, their combined weight has not been sufficient to create a groundswell of support for rapid growth in worker participation. The experience is just not there at this time to compel a belief that worker involvement is a panacea for dealing with the effects of change in the Canadian industry.

In part, the current experience with worker involvement is a function of the situation of the industry in Canada. The relative health and successful performance of the Canadian industry have reinforced the value of proceeding cautiously. Moreover, an industry structure made up of existing plants does not provide as many opportunities for major change. Although three new automotive assembly plants are now expected to be completed in the next three years, the Canadian industry has not had greenfield situations where new models can be considered and new agendas set for workforce management. Finally, fundamental change in workforce management requires time before experiences begin to translate into methods of operation and basic changes in approach.

The issue for the Canadian industry is how the needs of workers and the competitive pressures facing the industry will be accommodated. On the one hand, it is naive to expect that all such tensions can be removed by a new workforce management

model. On the other hand, the potential exists for meaningful worker involvement both to improve corporate performance and to address worker priorities.

If we turn from focusing on the extent of major new initiatives and focus instead on the results of the evolution for the Canadian industry, the significant point is that the bottom-line performance of the industry has been impressive from the perspective of both workers and the industry. Experiments and innovations in workforce management will continue to occur as they have in the past, but the most promising prospects lie in building on the positive and solid record of the industry's performance. This, rather than dramatic solutions or new found panaceas is the key to future competitive success.

CHAPTER 5

THE RISING SKILL REQUIREMENTS

The new technologies in the industry described in Chapter 3 and the changing nature of work organization detailed in Chapter 4 will each have a significant impact on the overall amount and specific kinds of skills required of the workforce in the future. There is currently a lively debate under way as to whether the new technologies and work organization practices will increase or decrease the level of skills expected of the average worker. On one side are those who argue that new technologies 'deskill' work, because skilled tasks formerly done by people are 'absorbed' or 'embodied' in the design of new automated equipment. On the other side are those who believe that new technologies will require more skills from the average worker, including a more sophisticated understanding of the entire work process.

The Task Force studied at some length the many aspects of this complex issue. Our investigations have led us to the conclusion that, although the level of skills needed is declining in some areas, overall skill requirements in the industry are rising. In particular, we have concluded that workers and managers are being required:

- to master more skills than ever before, including skills not expected of them in the past;
- to use these skills more frequently in the course of their daily work; and
- to adapt these skills more often to changing situations.

This increase in skill requirements is due in part to technological change, but it is also a result of changes in production methods, in quality control, and in workforce management. The combination of these developments, largely overlooked in the skilling/deskilling debate, forms the basis for the Task Force conclusion.

To understand the full implications of rising skill requirements, we begin by considering what the term 'skill' means in the automotive industry. Advocates of both the skilling and the deskilling position often confuse the issue by talking about skill in different ways. We then describe what is happening to overall skill requirements. There are two distinct aspects to this discussion. In the first place we examine how the individual skills required of all workers, regardless of occupation, are changing. We then discuss how the technical skills required in various occupations are shifting. Finally we describe the mix of occupations expected in the industry by 1990. As we shall see, not only are the skills required of most workers increasing, there is also likely to be a small but significant shift towards higher-skilled occupations.

WHAT IS SKILL?

The Task Force found that to understand how skill requirements are changing in the automotive industry, it is necessary to appreciate that there are many kinds of expertise that can be referred to under the umbrella term 'skill'. Work-related skills alone fall into four very different general categories:

1. **Basic skills:** These are the foundation upon which all other work-related skills are built. They include functional skills that the educational system aims to convey -- reading, writing, basic mathematics; motor skills, referred to by such terms as manual dexterity or hand-eye co-ordination; and employment skills required to get and keep a job -- showing up on time, calling in when absent, ability to follow instructions and so on.

2. **Analytical skills:** These include such activities as data-gathering, diagnosing, problem-solving, and decision-making. Widely expected of managers and the trades, these skills are thought to develop primarily through advanced education and subsequently from work experience.

3. **Interpersonal skills:** These include communicating information clearly, joint problem-solving, negotiating, and conflict resolution. These skills are often an important factor in hiring decisions and in job performance but are not always an explicit part of formal job descriptions.

4. **Technical skills:** These involve the application of knowledge specific to a particular area. These areas can include trade-specific knowledge such as die-making, pipefitting, welding, and painting and equipment-specific knowledge such as knowing how to operate specific machine tools, stamping presses or testing devices. These are the most specialized skills and are acquired from a variety of sources, including technical schools, apprenticeships, company and vendor training, and on-the-job training.

All workers, regardless of occupation, require some level of basic, analytical, and interpersonal skills. The technical skills required depend almost totally on the occupation and the specific nature of the work. Of course, certain occupations, say machine repair, require a far higher level of analytical skills and perhaps greater interpersonal abilities than most generally unskilled occupations. In fact each occupation in the automotive industry represents a particular configuration of the four types of general skills described above. We cannot describe in detail how the specific skill configuration of each occupation is changing. Instead, we will discuss the overall direction of change in basic, analytical, and interpersonal skills for all workers. We then explore changes in job-specific technical skills for the various occupations in the industry.

NEW SKILLS REQUIRED OF ALL WORKERS

The skilling/deskilling debate has often focused rather narrowly on the rapid advances in automation taking place in the automotive industry in recent years. In so doing it has overlooked many of the important developments in work organization and soft technologies like statistical process control, which are having equally profound effects upon industry skill levels. In particular, the level of basic skills, analytical

skills, and interpersonal skills required of all workers will be increasing, largely because of these other developments.

Basic
Skills

A solid grounding in the functional components of basic skills (literacy and mathematics) is more important in the industry than ever before. There are three main reasons why functional skills will be needed more than in the past:

1. **The switch to computerized technology** Older automotive production technology consisted primarily of electro-mechanical machines operated with switches and buttons. Operating such a machine does not require a high level of reading skills. The new computerized technology being introduced today is often controlled from a terminal where commands are typed in and information about machine functioning is displayed on monitors. Problems may have to be diagnosed by running diagnostic procedures from a terminal and reading the results of these tests from computer printouts. At a minimum, the operator has to have a good grasp of the technical language used.

2. **Increased information-gathering responsibilities** Production workers and skilled trades people alike are increasingly responsible for gathering and interpreting different kinds of data. This ranges from measuring output characteristics for purposes of statistical process control, to record-keeping on the rate of tool wear or the degree of machine vibration, to recording the proceedings of work group or quality circle meetings. SPC in particular is increasing the level of mathematical skills required of the workforce. Those using SPC must be comfortable with concepts such as mathematical averages, ranges, and graphing. Not only are hourly workers taking on information-gathering responsibilities that foremen or engineers may have been responsible for in the past, but also more information is being gathered throughout the plant.

3. **Increased need for higher-level skills** The need for stronger analytical, interpersonal and technical skills increases the significance of basic functional skills, which are the foundation of further skills development. As the frequency and sophistication of training increases to teach these other skills, the workforce will need solid literacy and mathematical skills to gain the maximum benefit from such training.

The major automotive assemblers have all found that the minimum level of functional skills required is increasing, especially among more technically skilled workers. As a result, at least one of the major automotive assemblers has introduced a minimum grade 12 requirement for all new entrants, skilled or unskilled. Another is hiring significant numbers of college graduates into supervisory positions, not as the first step in a management training program but as full-time, permanent jobs.

In the Task Force survey of the Canadian independent automotive parts manufacturers, over 60% of those responding reported that technology was increasing the reading, writing, and mathematical skills required of their skilled and semi-skilled workers.[1] A smaller proportion, about 40%, believed that basic skill requirements were increasing for their unskilled workers as well.

While the Task Force found compelling evidence that the level of basic functional skills required (such as reading and math) was increasing, trends in future requirements for basic manual dexterity and employment skills are different. Manual dexterity is still needed in many automotive industry jobs, and being 'good with your hands' is still a valued hiring criterion. But as computerization increases, motor skills are declining in

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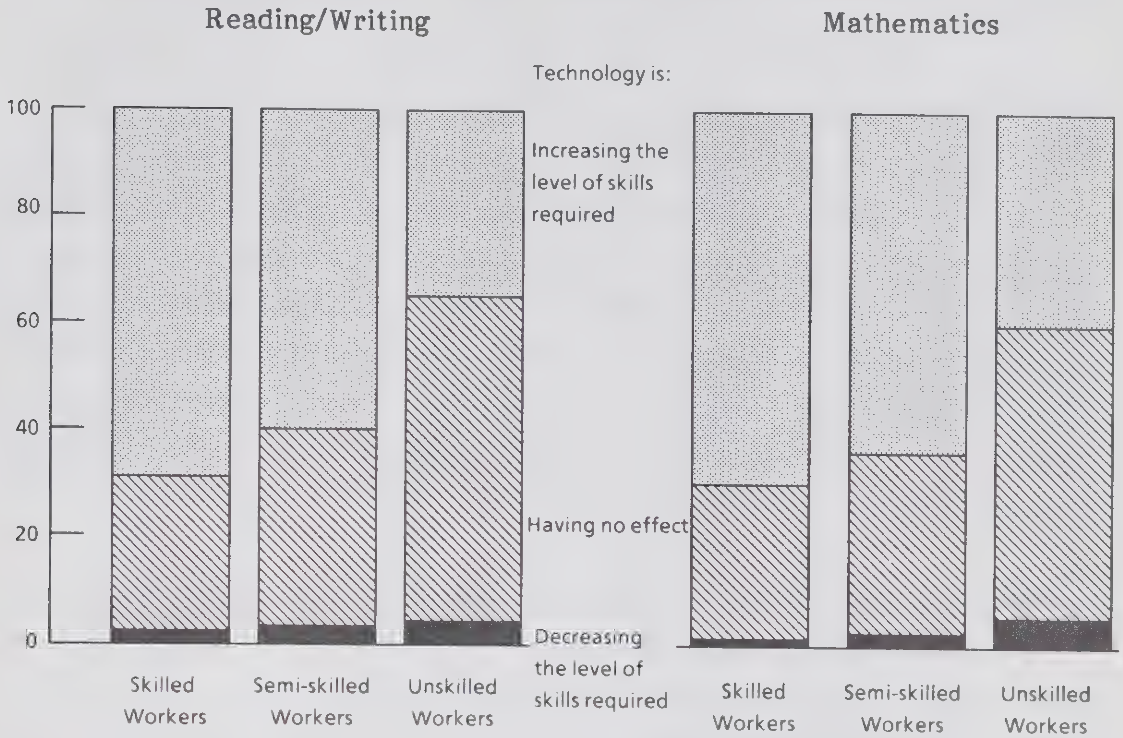
1. The difference between skilled, semi-skilled, and unskilled workers is explained later in this chapter

Figure 5.1
Managers' Perceptions of The Effects of New Technology on Basic Skill Requirements In the Independent Parts Workforce



Source: Task Force survey of the Canadian independent parts industry. The difference between skilled, semi-skilled and unskilled workers is defined later in this chapter.

importance relative to basic functional skills. Numerically controlled and computerized machines are specific examples of technologies that are changing the skills required of auto workers. The basic motor skills previously required to learn how to cut and shape metal on manually operated machines are much less important to the efficient operation of automated machines. Basic motor skills will continue to be important in the industry, but high levels of natural manual dexterity will be less important.

Employment skills -- showing up for work on time, having the ability to follow instructions and so forth -- are important and have always been so. The main point with respect to employment skills today, however, is the increasing tendency for assemblers and parts manufacturers alike to locate in less industrialized areas (especially rural areas) because of lower wage rates and the perception that workers new to an industrial setting may be more willing to adapt to new forms of work organization. To the extent

that companies favour such locations, they may need to teach more employment skills than they have to when plants are located in industrialized areas.

Analytical
Skills

We have already described how programs like SPC place measuring and record-keeping demands on the basic functional skills of the workforce. But to achieve their potential, such activities must be accompanied by analysis of the results. Although at present this analysis continues to be carried out predominantly by managerial or engineering staff, many companies are beginning to involve production workers in the process. This trend towards involving the workforce in analysis and problem-solving has increased the need for good analytical skills.

Changes in equipment technology are also affecting analytical skill requirements. Machine operators have always used analytical skills to learn the idiosyncrasies of their equipment, and this knowledge is often critical in achieving maximum uptime and quality output. But three trends are making analytical skills more important than ever for production workers:

1. **Shift from Operating to Monitoring** As the loading and running of production equipment is automated, a production worker's responsibilities change from machine operation to machine monitoring. By contrast with a machine operator, a worker monitoring one or more machines is almost wholly engaged in analytical work -- checking the quality of output, watching for signs of tool wear, and diagnosing the source of problems. The example of numerically controlled and computerized machines is a case in point. Once these devices are programmed, the worker's task is much more one of monitoring than of operating the machines.

2. **Increased integration of production systems** Sophisticated programmable controllers, electronic in-process gauges, automated transfer lines and other electronic equipment are increasing the level of equipment integration. This

integration is decreasing the level of human intervention required in normal operations while at the same time increasing the possible sources of system failure. Diagnosing problems becomes increasingly difficult and puts good analytical skills at a premium. The use of robots in spot welding in assembly plants is perhaps the best known example of system integration. When a problem is detected, workers monitoring the system must determine which robot among the 50 or more welding in sequence is the source of the problem.

3. **More abstract work** As more production equipment is operated by computerized controls, production workers are getting relatively more of their information about equipment from computer terminals and printouts and relatively less from physical contact with equipment and visual inspection. Dealing with this level of abstraction from the actual production process increases the level of analytical skills required to perform a job effectively and can be difficult for workers who have always relied on what they hear, see and smell to diagnose problems. Diagnostic testing is only one of many examples of the trend to more abstract work. At the Ford Windsor engine plant, for example, the hot testing of engines has been automated. Workers now monitor and interpret test results, rather than perform the tests themselves.

Interpersonal Skills

As with analytical skills, interpersonal skills are becoming more important in the daily activities of production workers, especially in plants moving towards increased worker involvement in production decisions. The co-operative problem-solving required in new forms of work organization (e.g., quality circles and work teams) does not always come naturally to group members. Though the advantages of co-operative problem-solving are often emphasized, there is little in our educational system or our workplaces to prepare people for working together successfully.

Choosing on group leadership, setting agendas and priorities, resolving personality conflicts, and deciding on a course of action -- each of these issues must be resolved

successfully by a group if it is to be effective. Plants like GM's Fiero in Pontiac, Michigan, that are built around work teams devote half of their 40-hour initial orientation to learning such group skills. Continued on-the-job training in group problem-solving expands on the initial training.

Communications skills also become important to work groups when they come up with good ideas to show management. The Employee Involvement (EI) program at Ford engine plants 1 and 2 in Windsor now offers training to EI groups in how to make an effective presentation, including speaking style and the use of charts and diagrams to support a case.

It is not only production workers who need to develop better interpersonal skills. As noted in Chapter 4, first-line supervisors and other managers are being encouraged to adopt a more participative management style, involving extensive consultation with workers and consensus-building. This represents a dramatic departure from the traditional "I'm the boss" approach and can rarely be accomplished without extensive training. Interpersonal skills have become an important hiring criterion for supervisors at many companies.

The interpersonal skill of negotiation also seems to be increasing in importance. The changing nature of relationships in some plants between management and workers and between workers themselves tends to increase the effort made to resolve disputes through informal mechanisms. Grievance procedures are generally available should these efforts fail, but both management and labour are interested in resolving as many disputes as possible outside the formal labour relations structure. Of course, informal negotiations will be a feature of almost any industrial setting and the change here is one of degree rather than one of kind.

TECHNICAL SKILLS CHANGE WITHIN OCCUPATIONS

It is the area of technical skills that is experiencing the greatest flux. In contrast with other types of skills, new technology is causing a decline in the importance of some technical skills. In many other areas, however, new technology is imposing increased technical skill requirements. Just as significantly, there is a shift under way in the distribution of technical skills across some occupations -- especially in the skilled trades. There are also increasing demands for greater flexibility among the workforce in terms of the number of technical skills each worker has and how many jobs each worker can perform. Thus, to understand the changes in technical skills required in the industry, it is important to look at individual occupations.

Changes In The Skilled Trades

All of the skilled trades in the automotive industry are experiencing major changes in the complexity and type of skills required for the job. Tool and die makers, for example, are finding that computer-controlled methods of preparing dies from master copies are reducing the demand for complex die-making skills. Similarly, the increased role of production workers in tool and die changes reduces the scope of die trades activity. However, the most complex and skilled work of all -- the making of original dies and tools from blueprint specifications -- is still a critical and highly skilled aspect of the die maker's art. In time, though, that role will to some extent also be usurped by improved CAD/CAM systems.

Electricians, on the other hand, are finding that new technology is greatly increasing the skills they require. The introduction to the workplace of a whole range of microprocessor-based equipment -- from robotics and programmable controllers to test equipment and personal computers -- has almost introduced a whole new trade, that of electronics. The repair and maintenance of this equipment requires far higher and more complex skills than traditional electrical work. There is a debate currently under way in

a great many plants about this situation. Some argue that a new trade of electronics should be formally recognized and that those with significantly higher levels of skills should be rewarded accordingly. Others (especially the electricians themselves) argue that all those currently qualified as electricians should be trained further to satisfy the new requirements for electronics expertise.

Some observers are cautioning, however, that the debate is bound to be short-lived, as the next generation of production technology will end this period of high demand for people trained specifically in electronics. The next generation of equipment will be designed to run its own diagnostic tests and identify the sources of problems without human help, limiting the task of electronic maintenance and repair to the replacement of faulty circuit boards.

Changes In Semi-Skilled Occupations

Not all workers with identifiable sets of skills related to a specific process are organized into formally recognized trades. These workers are most often referred to as the semi-skilled, and their occupations can generally be considered non-trade hourly positions in the industry for which workers require more than 30 days of job training to be proficient. In many cases learning these jobs can require up to two years of training. Examples include non-trade production machinists, sewing machine operators, molders, hammerpeople, and precision inspectors.

As with the skilled trades, new technology is affecting these occupations in varying ways. Cutter/grinders, who grind and sharpen tools for reuse, are finding their skills requirements declining. Usually requiring one to two years to become proficient and up to ten years to become expert, this is perhaps the most highly skilled non-trade hourly position in many plants. Traditionally, cutter/grinders had to be able to sharpen hundreds of different kinds of tools and thus had to able to run many different kinds of cutting and grinding machines. With the increasing introduction of numerically controlled and computerized machines for tool sharpening, the variety of skills formerly required is being reduced. Moreover, some manufacturing systems are dispensing with

tool regrinding altogether, replacing it with disposable tools that are easily changed and discarded.

In some semi-skilled areas, such as welding and painting, entire occupations are being virtually eliminated except for repair and touch-up work. Assembly plant body welding and painting work has been taken over almost completely by robots in the newest plants. General Motors, Ford and Chrysler have all introduced robots to their Canadian assembly plants, and the new American Motors plant at Brampton will also have significant numbers of robots.

Other semi-skilled occupations, in areas such as stamping and casting, may be affected by forthcoming technological developments. Powder metallurgy, ceramics and the increased use of plastics and composites are examples of emerging product technologies with implications for the mix of non-trade skills requirements in the production process. Monroe Shocks in Collingwood, Ontario, is an example of a company using powder metallurgy in the manufacture of small metal fittings for shock absorbers. For these parts, powder pressing and heat treatment operations have replaced grinding and stamping operations, requiring completely different machines operated by individuals with different process-related skills.

In other semi-skilled occupations, the level of skills required is unambiguously increasing. Precision inspectors in many plants now have to understand gauge readings, perform regular gauge accuracy tests, and undertake more complicated visual checks than they did previously. Job setters often find that they now have to use SPC as part of their specific occupation, and in some plants new semi-skilled positions have been created specifically for full-time SPC co-ordinators. As with the skilled trades, the effects of new technology and work organization practices affect each semi-skilled occupation somewhat differently, and no single trend towards increased or decreased technical skills is emerging.

The Push For Flexibility

The increasing complexity of the new technologies, in combination with severe competitive pressures, is resulting in pressure on some workers to learn a greater number of technical skills. Demands for greater job flexibility in the workforce are not new, but more is happening now than in the past.

For many in the mechanical trades (e.g., mechanics, machinists, millwrights, and pipefitters), the new technologies are resulting in a blurring of the traditional lines of demarcation. These people are being asked to draw on the full range of hydraulic, mechanical, and electrical principles in the repair of equipment and machinery. Electricians are undertaking minor hydraulic and mechanical repair work to a degree unheard of ten years ago. Competitive pressures are causing management and labour to re-evaluate the usefulness of so many classifications. The Task Force found several examples of management and workforce co-operation in redefining job content in order to increase the flexibility of the skilled workforce.

Semi-skilled workers are also finding their technical skill requirements broadening. The most common example we found is the small but increasing trend to having machine operators initiate routine maintenance and minor repairs on their equipment. The concept of work teams is also spreading,with workers assigned to an area rather than to specific jobs. An area may include up to ten jobs, and at some plants pay-for-knowledge wage increases are awarded as workers qualify to do more jobs.

These moves to increased flexibility are more noticeable at larger companies than at smaller ones. The smaller firms have always had to be more flexible to survive and often do not have the workforce requirements to justify hiring people to fill narrow job descriptions. It is in part for this reason that a larger company like Magna operates a number of comparatively small plants: among their other virtues, small plants can force flexibility into the system.

THE CHANGING OCCUPATIONAL MIX

This chapter has thus far considered the implications of change in the automotive industry for the skills requirements of individual workers. We have concluded that across many kinds of skills the automotive worker of the future will have to know more.

The Task Force also investigated the effect of changes in the industry on future aggregate skill requirements across occupations. We have found that the mix of occupations in the workforce is shifting in two ways. First, the number of people in the more skilled occupations is increasing relative to the number in less skilled occupations. This trend is a gradual one: unskilled workers will still make up the largest segment of the workforce in 1990. Secondly, there is a shift under way in the responsibilities of a number of occupations, especially in the skilled trades. In general, the shift is leading to a broadening of job content, but again the trend is a gradual one. The balance of this chapter reviews trends in the occupational skill mix of the workforce.

It should be emphasized at the outset that there is nothing inherent in technological change that makes any particular industry skill mix inevitable. A significant conclusion of our work is that the new technologies can create rather than close off options for the design and staffing of the workplace.

One example is the application of automated equipment in an assembly environment. If automation is applied very rigourously, the jobs that remain may be very tightly controlled. For example, if the practice of banking is eliminated because all sub-assembly work is incorporated into a semi-automated assembly line, workers on that line will be completely tied to the pace of the machines, with potentially negative effects on motivation and morale. But the system could also be designed to maintain the desirable features of a sub-assembly/assembly environment, including flexibility in the pace of work, while capitalizing on the most important advantages of automated production, such as consistency of work or removing workers from unpleasant or hazardous jobs.

Another example relates to just-in-time production systems. Just-in-time production can increase stress levels, because eliminating buffer stock forces workers to respond that much more quickly to production problems. If jobs are restructured so that workers have the authority and resources to manage problems as they arise, stress can become a positive part of the response to challenges. Without job restructuring, stress can be an extremely negative force. Workers may find themselves under pressure to produce but unable to take the actions required to solve problems.

It should be clear then that the trends we have observed are not inevitable; rather, they are the results of explicit decisions about which technologies to apply and how to apply them.

Specific Occupational Trends

To assist in clarifying the broad employment trends in the workforce, the Task Force developed a list of 32 occupations describing virtually every hourly job in the industry (see Table 5.1). The motor vehicle manufacturers and the independent parts manufacturers were then asked to describe their workers in terms of these 32 occupations. The result was a profile of the occupational structure of the Canadian automobile industry.

Table 5.1

Automotive Industry Occupations

Category	Occupation
Skilled work (two or more years of training to be proficient on the job)	Electrical, all Mechanical - Trade mechanics/machinists - Pipefitters - Millwrights - Trade welders - Carpenters - Painters - Glaziers Tool - Tool/Tool & die makers - Pattern makers - Die sinkers
Semi-skilled work (30 days to two years training to be proficient on the job)	Production machinists Sewing machine operators Production workers, semi-skilled Assemblers, semi-skilled Production painters, all Molders Other foundry production operators, semi-skilled Hammerpeople Other forge production operators, semi-skilled Inspectors, precision/final Leadhands/utility relief including all senior hourly assistants to supervision
Unskilled work (less than 30 days training to be proficient on the job)	Machine operators Production workers, unskilled Assemblers, unskilled Core iron operators Other foundry production operators, unskilled Heaterpeople Other forge production operators, unskilled Material handlers, including shipping & receiving, and stock operations Inspectors, production Environmentalists, including janitors/ sweepers/general labour

The 32 occupations can be divided into three broad categories:

- **skilled workers:** requiring two or more years to become proficient on the job
- **semi-skilled workers:** requiring more than 30 days but less than two years to become proficient on the job
- **unskilled workers:** requiring less than 30 days to be proficient on the job.

Table 5.2 provides a picture of the skills mix of the automotive industry. Unskilled workers are the dominant group, comprising 62% of all hourly workers.

Table 5.2

Skills Mix of the Canadian Automotive Industry Workforce

Category	Major Automotive Manufacturers	Independent Parts Manufacturers	Total
Skilled	12%	13%	12%
Semi-skilled	27%	25%	26%
Unskilled	61%	62%	62%
	100%	100%	100%

Source: Calculations based on Task Force survey of the Canadian independent parts industry and information provided by the motor vehicle manufacturers.

Taken at face value, one interesting finding would appear to be the surprising similarity in skills mix between the automotive and the independent parts manufacturers. It has often been suggested that the parts manufacturing industry has a relatively more skilled workforce. It should be remembered, however, that the major automotive manufacturers are significant parts manufacturers in their own right, with perhaps 23,000 of their approximately 62,000 hourly workers working in parts plants. To the extent that the Task Force was able to separate out parts plant workforces from

assembly plant workforces, the conventional wisdom was confirmed: parts plant workforces are relatively more skilled than assembly plant workforces. These calculations were necessarily approximations because of the way the major assemblers record occupational populations. However, by way of illustration, Ford Canada's skill mix splits out roughly as follows:

	Assembly Plants	Parts Plants
Skilled workers	7%	21%
Semi-skilled workers	17%	33%
Unskilled workers	76%	46%
TOTAL	100%	100%

The Task Force devoted considerable effort to developing an understanding of employment trends for occupations in the industry. The analysis that follows focuses on the proportion of the total workforce each occupation can be expected to account for in 1990 compared with today. In Chapter 8 we go on to look at the broader question of how large that total workforce might be in the future.

Skilled Work

Skilled workers -- including all tradespeople and certain other workers with specialized training -- make up 12% of the total automotive industry workforce. The effects of technology on skills requirements have been greatest for workers in this category. Overall, the proportion of total skilled workers in the industry is expected to rise over the next five years, despite the fact that certain skilled trades may see a reduction in numbers (see Table 5.3).

Table 5.3
Occupational Distribution of Hourly Workers in the Automotive Industry, 1985 and 1990

Skilled Workers

Occupations	1985 Actual Employment				1990 Projection
	Independent Parts	OEM	Industry Total	Percentage of Total Hourly	Percentage of Total Hourly
Electrical, all	474	1,823	2,297	2.2	3.0-3.5
Mechanical					
- Trade mechanics/ machinists	977	1,557	2,534	2.4	
- Pipefitters	219	716	935	0.9	5.7-6.0
- Millwrights	842	1,111	1,953	1.8	
- Trade welders	209	188	397	0.4	
- Carpenters, Painters, Glaziers	83	169	252	0.1	
Tool					
- Tool & die makers	1,682	1,399	3,081	2.9	3.1-3.5
- Pattern makers	190	154	344	0.3	0.3
- Die sinkers	144	48	192	0.2	0.2
Other	519	653	1,172	1.2	1.2-1.4
Total, skilled workers				12.4	14.0-14.5

Source: Calculations based on the Task Force survey of the Canadian independent parts industry, information provided by the motor vehicle manufacturers and discussions with industry associations.

Regardless of which technologies are chosen by the automotive industry between now and 1990, the demand for electricians will continue to be strong. The assemblers all reported that the proportion of electricians in the workforce would be increasing. In the survey of Canadian independent parts manufacturers, respondents reported an overall proportional increase of 37% in the number of electricians expected on the

payroll between now and 1990. The Task Force estimates that the proportion of electricians in the entire industry workforce will rise by at least this amount and possibly more.

The outlook for the mechanical trades is mixed. Both the assemblers and the parts manufacturers expect the total population of these trades, as a proportion of the workforce, to remain about the same or to increase only modestly. However, there is also the expectation that changing technology will increase the pressure to blur the distinctions between these trades in order to satisfy a changing balance of needs. Although the number of workers in the mechanical trades may, as a proportion of the total workforce, remain the same, the structure of these trades at some plants may change.

The trend for the tool and related trades is also mixed. While parts manufacturers reported a 20% overall proportional increase in their relative requirements over the next five years, certain of the assemblers felt that their needs would be decreasing relative to the demand for other trades. Reasons cited included changing tool design and manufacturing technology, and changing product design and materials. Further, much of the growth in the tool trades was concentrated among very few companies. However, a modest increase in proportion is anticipated, if only because the reduction in the proportion of unskilled workers will automatically increase the proportion of skilled workers.

Overall then, the relative number of skilled tradespeople is expected to rise somewhat.

Semi-skilled
Work

Semi-skilled workers make up 26% of the automotive industry workforce. This proportion is expected to increase modestly to 1990, although most of any increase will be the result of trends in only a few of the semi-skilled occupations (see Table 5.4).

Table 5.4
Occupational Distribution of Hourly Workers in the Automotive Industry, 1985 and 1990

Semi-skilled Workers

Occupations	1985 Actual				1990 Projection
	Independent Parts	OEM	Industry Total	Percentage of Total Hourly	Percentage of Total Hourly
Production machinists	2,607	2,012	4,619	4.3	5.5-6.0
Sewing machine operators	261	1,806	2,067	1.9	1.9-2.0
Production workers, semi-skilled	2,608	2,019	4,627	4.3	5.0-5.5
Assemblers, semi-skilled	1,858	76	1,934	1.8	2.5-3.0
Production painters, all	182	1,126	1,308	1.2	0.9-1.1
Moulders	152	188	340	0.3	0.3
Other foundry production operators, semi-skilled	179	524	703	0.7	0.7
Hammerpeople	124	753	877	0.8	0.8
Other forge production operators, semi-skilled	296	1	297	0.3	0.3
Inspector precision/final	1,108	746	1,854	1.7	1.6-1.8
Leadhands/ utility relief including all senior hourly assistants to supervision	1,069	7,568	8,637	8.1	8.0-8.2
Other	300	225	525	0.5	0.5-0.7
Total, semi-skilled workers				25.9	29.0-30.0

Source: Calculations based on the Task Force survey of the Canadian independent parts industry, information provided by the motor vehicle manufacturers and discussions with industry associations.

In particular, the proportion of semi-skilled production workers and assemblers is expected to grow. This trend will occur as the skills generally required of these occupations increase, shifting some of the workforce out of the category of unskilled work and into semi-skilled work. The strong growth in the proportion of semi-skilled production machinists is also part of this trend: increasingly machine workers will require more than 30 days of training to be proficient on the job.

The relative proportions of most semi-skilled occupations are expected to remain about the same. Despite the trends in total quality control, the proportion of semi-skilled inspectors may even increase slightly, providing further evidence of the evolutionary pace of change in the industry. Only production painters are definitely expected to decrease as a proportion of total workers.

Overall, the share that semi-skilled workers have of jobs in the automotive industry, along with the share of skilled workers, is expected to increase somewhat to 1990.

Unskilled Work

Unskilled workers, accounting for 62% of the automotive workforce, were defined for the purposes of the work of the Task Force as those workers in jobs where one is considered proficient after 30 days of training or less. Most unskilled occupations are expected to make up a smaller proportion of the workforce in 1990 compared with today (see Table 5.5).

Table 5.5
Occupational Distribution of Hourly Workers in the Automotive Industry, 1985 and 1990

Unskilled Workers

Occupations	1985 Actual Employment				1990 Projection
	Independent Parts	OEM	Industry Total	Percent ageof Total Hourly	Percentage of Total Hourly
Machine operators	11,095	2,245	13,340	12.5	11.0-13.0
Production workers, unskilled	4,179	5,116	9,295	8.7	8.0-8.5
Assemblers, unskilled	5,871	20,038	25,909	24.3	18.0-22.0
Core iron operators	145	513	658	0.6	0.4-0.6
Other foundry production operators, unskilled	351	44	395	0.4	0.4
Heaterpeople	87	113	200	0.2	0.2
Other forge production operators, unskilled	127		127	0.1	0.1
Material handlers, including shipping & receiving, and stock operations	2,404	4,960	7,364	6.9	6.3-6.7
Inspectors, production	1,328	3,640	4,968	4.7	3.5-4.0
Environmentalists, including janitors/ sweepers/ general labour	753	2,237	2,990	2.8	2.7-2.9
Other	299	225	524	0.5	0.5-0.7
Total, unskilled workers				61.7	53.0-58.0

Source: Calculations based on the Task Force Survey of the Canadian independent parts industry, information provided by the motor vehicle manufacturers and discussions with industry associations.

The most significant reductions will be in the proportion of assemblers, although a high degree of uncertainty remains about how fast this shift will occur: the proportion of unskilled assemblers in the workforce could fall by between 2 and 6% from the present 24%.

The proportion of unskilled inspectors is also expected to fall, although at 3.5% -- the bottom of our forecast range -- there will still be more than one inspector for every 30 workers in the industry.

The trend for machine operators is also unclear. While our best guess is that the proportion of these unskilled workers will fall, the decisions companies make about how to integrate machines with workers and the way process technologies such as SPC are managed could result in an actual increase in the proportion of these workers.

The proportions of other unskilled workers are expected to hold steady or fall modestly. Overall, the shifts out of unskilled labour into more skilled labour are not dramatic. The share of unskilled labour as a percentage of the workforce may fall only 3.7%. However, the shift does reflect the steady movement in the industry towards a higher skill mix. It is also important to remember that the labels skilled, semi-skilled and unskilled do not convey the increase in skills required in all classifications, as discussed in the first half of this chapter.

It is worth noting that the Task Force expectations concerning the aggregate skill mix in the industry would need to be modified somewhat if the four assembly plants scheduled to come on stream between now and 1990 (AMC/Renault, Honda, Hyundai and Toyota) have skill mixes considerably different from existing assembly plants. While the AMC/Renault plant is expected to have a broadly similar mix, the anticipated industry shift to a more skilled workforce will be tempered to the extent that workers at the Honda, Toyota and Hyundai plants are merely unskilled assemblers of knockdown kits. The figures for Ford Canada's skill mix in its assembly and parts plants clearly show the skill mix implications of any aggregate trend in Canada toward straight assembly operations and in fact, knockdown kit assembly would ordinarily require even lower skill requirements than are found in the traditional North American assembly operation.

NEW
DEMANDS ON
SALARIED STAFF

This chapter has concentrated on the rising skill requirements and the shifting skill mix to which hourly workers are being exposed. Salaried workers have not been immune to changes in industry skill and employment trends. The need to learn new skills, the broadening of job content and the elimination of certain occupations in some plants are part of their turbulent environment as well.

Depending on who is counted, salaried workers comprised from 12 to 22% of all automotive industry workers. Among respondents to the Task Force Survey of the Canadian independent parts industry, salaried workers made up 22% of the total workforce.

As Table 5.6 shows, about a third of independent parts industry salaried workers are in technical or enginering occupations and about a fifth are in secretarial or clerical occupations. The balance are managers, or have other salaried positions in areas such as sales and corporate staff. The proportion of these occupations in the parts industry workforce is not expected to change significantly between now and 1990 either with respect to each other or with respect to the hourly occupations.

It is more difficult to discuss the population proportions and trends vis-à-vis the major automotive manufacturers because of the wide variation in the kinds of operations the manufacturers have in Canada. While none of the assemblers have substantial engineering and technical operations here, some have significantly more activity than others. The proportions and reported trends reflect those differences and compromise the usefulness of any summary chart.

Salaried employees -- of automotive manufacturers and part industry companies alike -- are experiencing at least as much change in their work environments as hourly workers. For every impact of new technology on the hourly worker, there is a corresponding impact for salaried workers. What that impact is of course varies by the type of technology and by the level of the worker.

Table 5.6

Breakdown of Salaried Personnel
Canadian Independent Parts Manufacturers

	Percentage	
	Current Proportion	1990 Percentage Projection
Engineers	17	17
Technicians		
. Computer systems	11	10
. Robotics/Other Electronic	1	2
. Laboratory/R&D	4	5
. Other	1	1
Managers	19	19
Secretarial/Clerical	22	20
Other Salaried	25	26
Total	100%	100%

Source: Task Force survey of Canadian independent parts manufacturers.

Statistical Process Control is a good example of how the skill requirements of managerial and technical staff are changing. In some situations, these people are having to learn how to use SPC. For some, as with hourly workers, this may mean having to use mathematical skills which were not required in the past. This would be the typical situation facing, for example, the first-line supervisor.

For many supervisors though, the implications of SPC go beyond the technical level to the very way the supervisor has to manage. The Task Force learned of cases where hourly workers had been trained to use SPC before supervisory staff. For supervisors used to possessing a general grounding in the skills required of their subordinates, this posed a threat to their authority, in some cases making them less interested in ensuring the success of the technology. At a minimum for others, it forced them to revise their relationship with their subordinates to recognize the shift in the balance of expertise.

Even more fundamental are the implications for managerial and technical personnel of the trend to group problem-solving and team work as raised in Chapter 4. We have already made reference to the demands these changes place on the analytical and interpersonal skills of the hourly workforce. For these workers, the changes on the whole represent a gain in involvement and status. For managerial and technical workers, the changes -- involving the need for different kinds of interpersonal skills and the sharing of analytical skill responsibilities -- lead to a sense that power is being lost.

At some locations the context of management-labour relations has determined the success of changing reporting structures. However, at others, the Task Force found the attitude of management and technical staff was the critical determining factor. For example, at one plant where hourly workers were invited to participate in the redesign of their immediate workstations, the engineering staff was openly hostile to the suggestions made. However, at another plant, after initial suspicions, technical staff worked enthusiastically with hourly workers in selecting a vendor for specialized area cooling equipment. It is worth noting that the company in this latter case reported to the Task Force that, in the end, it was the vendors who were reluctant to work with hourly personnel rather than the technical staff.

With respect to the proportion of hourly versus salaried workers in the industry workforce, the Task Force found that the industry as a whole was not expecting any change. In some cases, especially where explicit productivity targets include workforce reductions if necessary, salaried workers are not excluded. Experience from the first half of the 1980s, however, is that while downward adjustments in the number of hourly workers can occur fairly rapidly, adjustments in the number of salaried workers follow with a lag of from one to three years.

Specifically, while the downturn in 1982 led to the almost immediate laying off of hourly workers, significant reductions in the numbers of salaried staff began in 1983 and in some cases have continued through 1985. Up to a third of salaried positions were eliminated compared with peak employment in the major assemblers and at least two of the assemblers expect that ultimately the number of salaried positions will be half that of peak levels. New technology has eased the load on these that remain, but simply working harder, and smarter, has also been required. At AMC/Renault Canada for

example, reduced staff support resulted in the elimination of certain reporting requirements seen to be of only marginal value.

MAKING THE SHIFT

As should be clear from this chapter, we cannot really answer the question of whether skills levels are increasing or decreasing in the industry without understanding the nature of the various kinds of skills and without examining the trends by occupational categories.

Having undertaken this analysis, we believe several conclusions can be drawn.

1. Many of the tasks most easily automated are those that require the least human skill. This means that as more and more tasks are automated, those that are not automated will contain a higher average skill content. Hence, the average skill level of jobs tends to increase as automation increases.

2. Some advocates of the deskilling position describe technology as taking over or embodying skills from people. The metaphor assumes a zero-sum distribution of skill -- if more skill is embodied in technology, less skill is left for people to exercise. However, this assumption misses a key point: even when technology takes over tasks formerly done by workers, there is a significant new task, that of running the new technology. Tending sophisticated technology often requires the use of analytical skills not previously needed.

3. Skill requirements are affected by more than skill-embodying technology. Perhaps even more significant than changing equipment technology are soft technologies like statistical process control and just-in-time production. These new approaches to quality control, production methods and workforce management are having a significant impact on the level of skills required in the workforce, quite apart from the skill requirements of the new equipment technology.

4. Managerial choices about how to apply a particular technology can be at least as important as the choice of technology itself in terms of influencing the skill levels required and issues affecting job content in general. The most successful examples the Task Force found were those where management and labour had worked together to understand the choices that could be made and to make decisions accordingly.

5. For better or worse, technological change in the automotive industry is having a profound effect on the skill requirements of those working in the industry. Skilled workers and semi-skilled workers alike are having to know more, and there will be relatively more of these workers. Unskilled workers are also having to know more; however, their share of the total size of the workforce is expected to decline to some extent over the next five years.

We have described in some detail the changes affecting skill requirements in the automotive industry. Its future competitiveness will depend on the ability of the workforce to make the transition. On present evidence, the existing workforce looks capable of making the transition. The training effort that is under way to bring about that transition is the subject of the next chapter.

CHAPTER 6

THE TRAINING CHALLENGE

The competitive demands of the new automotive world and the higher skill requirements brought on by technological changes have combined to increase greatly the amount and range of training necessary in the Canadian automotive industry. Across the industry a mammoth effort is under way to mobilize the resources needed to provide this heightened level of training. The success of this training effort will be critical to the overall success of Canada's automotive sector. In this chapter we examine the new training requirements in the industry and the significant challenge they pose to the resources of automotive companies, and the efficacy of government training programs. We also explore the likelihood of skill shortages and the extent to which formal human resource planning systems are used in the industry as a means of improving the staffing and skills development processes.

THE NEW TRAINING REQUIREMENTS

Training is nothing new to the automotive industry. From their earliest days automotive companies had to train thousands of workers just out of school or right off the farm. Training ran the gamut from the basic employment skills necessary for an industrial workforce to highly specialized skills particular to the automotive industry. Traditionally, most of the simple skills were taught on the job; only those that constituted trades, such as tool and die making, made use of structured programs.

Because most learning in the automotive sector has traditionally occurred on the job, the industry's commonly held notion of training usually referred only to formal courses of instruction or apprenticeship. Now, training is viewed as the entire process of skills acquisition including both informal activities on the job and formal work with instructors. Much of the formal training now available in the industry is in 1 to 10-day packages aimed at updating the skills of the existing workforce. The industry is moving from a focus on training workers entering the industry to a focus on retraining the existing workforce to adapt to technological and competitive change. As a result, the number of hourly workers exposed to formal training has increased dramatically.

The new kinds of training now offered range widely from health and safety to product familiarity, maintenance and repair of new technology, and basic skills education for workers that never completed high school. Additional training is required when soft technologies like SPC are introduced. The industry's efforts to increase the flexibility of workers by developing multiple skills for a number of jobs has also increased the amount and kinds of formal training on offer. Further, the shift to greater worker involvement in production decision-making requires training in problem-solving and communication skills. To examine the new training requirements in detail, we use the skills framework introduced in Chapter 5: basic skills, analytical skills, interpersonal skills and technical skills.

Basic Skills
Training

Basic functional skills such as reading and mathematics are becoming more important than ever because of their increased use on the job and because they are essential to learning more advanced analytical and technical skills. The industry is concerned that the level of basic skills in the workforce is not as high as it needs to be. Similar to many of the comments heard during our study was one made by a plant manager who noted, "The lack of adequate mathematical and reading skills in much of our workforce is making the introduction of SPC and other new systems very difficult. We had no idea how many people could not read or do math at a high school level. In fairness to our workers, we never expected much from them before."

This is not to say that the problem of insufficient basic skills is widespread across the workforce. The vast majority of workers do have adequate basic skills, but a sizable minority are suffering from inadequate literacy and mathematical abilities. The exact dimensions of the problem are hard to define, but our survey of the independent automotive parts industry does provide one indication.

The survey asked managers how adequate they found the basic skills of their hourly workforces. Their results are shown in Figure 6.1. Of the companies responding, 29% said that reading and writing skills in their current workforce were often inadequate. Somewhat fewer, only 21%, said that the reading and writing skills of workers just entering their employ were often inadequate, indicating that inadequate literacy is more of a problem with the existing workforce, whose members are likely to be longer out of school than are new entrants to the workforce.

Basic mathematical skills appear to be even more of a problem, with 36% of responding companies indicating that the mathematical skills of their current workforce are often inadequate. As with literacy, it appears that new entrants to the workforce fare better. Only 24% of the companies responded that the mathematical skills of new entrants to their workforces were inadequate.

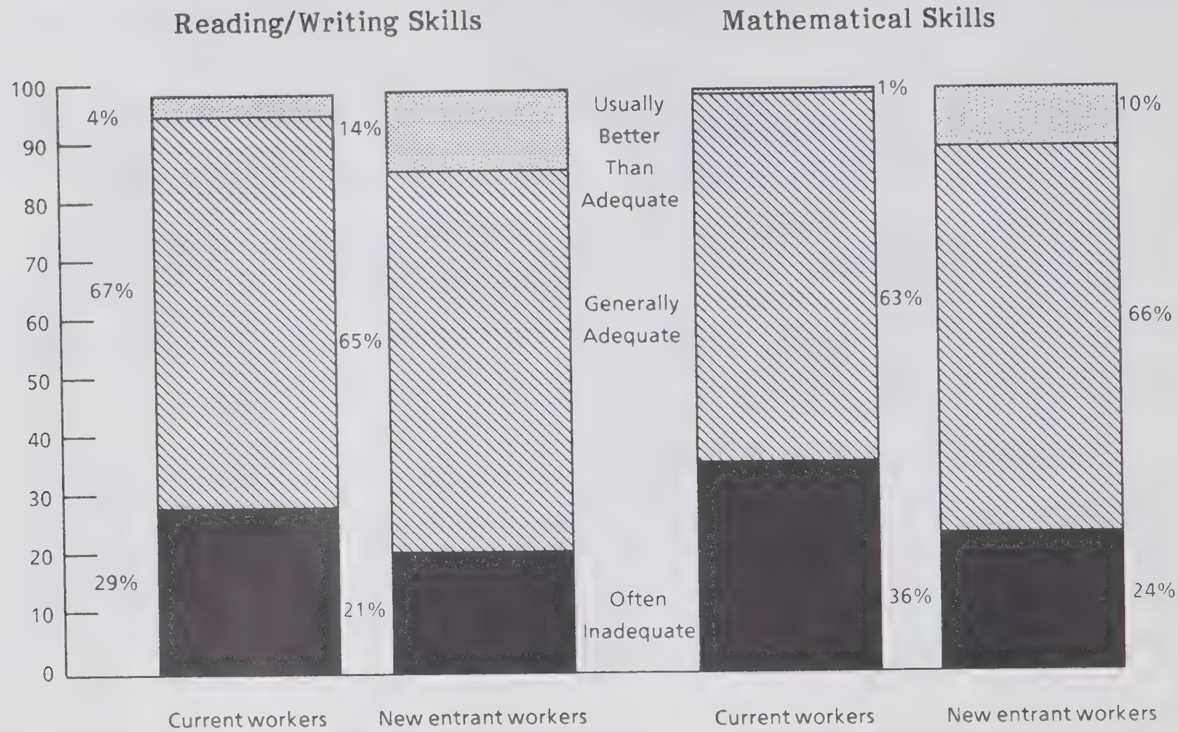
The automotive industry is responding to the need to improve basic skills in a number of ways. Many companies are offering basic skills programs to workers on a voluntary basis. This can include a full course of studies leading to a high school equivalency certificate, or individual reading and math improvement classes. In some plants all hourly workers are being put through a brief 8- to 16-hour course in high school-level math or physics to assure knowledge of certain basics. Other short classes may teach specific basic skills like graphing and charting to prepare for the introduction of SPC or other new technologies.

A second approach to the basic skills problem is to send workers to community colleges or adult education programs to take refresher courses or study for a high school equivalency certificate. This approach is employed widely in plants where many of the literacy problems stem from the large number of immigrants in the workforce. Usually,

Figure 6.1

Managers' Perceptions of Basic Literacy and Mathematical Skills in the Independent Parts Industry Workforce

How do you find the basic educational skills of your hourly workforce?



Source: Task Force survey of the Canadian Independent parts industry by the Automotive Human Resources Task Force. See also Appendix 2.

these workers can be accommodated best in public programs designed to teach English or French as a second language.

The third approach the industry is taking to the basic skills issue is to raise the hiring requirements for hourly workers. Ford, for example, now requires a Grade 12 certificate for all new employees. Other firms do not require it but clearly prefer it and in practice are getting mainly high school graduates.

Several companies complained, however, that even a high school certificate is no longer a guarantee of basic skills. We hasten to note that only a few firms interviewed felt this way, but many companies believed the public schools were doing only an

adequate job and could do much more to prepare students for the kinds of challenges they will face in the automotive industry. As the vice-president for human resources of one of the country's largest automotive companies put it, "We need better qualified high school students. The schools have to go beyond basic reading and math to teach more problem-solving skills, more general science, and especially more applied science. If we get bright, well educated kids out of the school system, we'll have no problem teaching them the new electronics."

Analytical Skills Training

In Chapter 5 we concluded that the need for analytical skills was rising across the industry. For many specific occupations, like the skilled trades involved in machine maintenance and repair, the analytical requirements for performing a job are increasing dramatically. But with the introduction of SPC, almost all workers are finding that they are expected to use more analytical skills in their work.

Most companies are organizing their own educational programs to develop analytical skills, although they draw on available courses at community colleges and elsewhere when possible. The kinds of analytical skills and concepts being taught include SPC, gauge analysis, geometric tolerancing, and various kinds of problem-solving. Some of these skills might be taught as part of technical training related to specific jobs or pieces of equipment, but much of it is presented in classes dedicated to teaching that particular skill.

Easily the most widespread type of analytical thinking taught in the industry today is statistical process control. As we noted in Chapter 3, many companies believe that to implement SPC effectively, they have to involve most of their workforce in using the system. This means a massive effort to train everyone from plant managers to workers on the shop floor. Usually the plant engineering staff or designated technical specialists with responsibility for coordinating and facilitating the introduction of SPC are the first to be taught. These specialists could participate in a 4 or 5 week basic SPC course at a

university or technical institute, with additional courses if they require more advanced techniques.

After a few specialists are trained and a plan for introducing SPC is formulated, supervisory people are usually the next to receive training. They must not only become familiar with SPC's basic principles and methodology but also be able to teach and explain SPC to the hourly workers in their work areas. This can require as much as 40 to 80 hours of training. The hourly workers that will actually use SPC as a diagnostic tool must have at least as much knowledge about SPC as their supervisors. And those hourly workers who will record and monitor SPC information must have at least enough knowledge to understand the basic premises of SPC and the skills to carry out their roles. Typically, companies are offering workers a minimum of 8 hours of basic SPC training. Many companies are also teaching workers who will not be using SPC -- office staff for example.

The automotive industry has never experienced a training challenge as large as that represented by SPC. In the next five years most companies in the industry will be teaching most of their workers its techniques. General Motors of Canada, for example, estimates on the basis of a plant-by-plant survey of training needs that they will have to provide over 1.5 million hours of SPC and related quality control instruction to their workforce over the next five years; this averages out to 40 hours of training per employee. Ford has done no overall projections, but individual plants have similar goals for SPC training. Chrysler is just beginning to introduce SPC and aims to train 4.5% of its 11,700-person workforce in SPC during the next year. Courses will range from a 16-hour introductory program to a 40-hour technical class. All told, nearly 14,000 hours of training will be provided, for an average of 26 hours per person trained.

The extent of SPC instruction already under way is enormous. The vehicle companies have moved most quickly in their captive parts facilities. GM's Windsor Transmission Plant is a typical example. Virtually all managers and nearly 30% of the hourly workers at the plant have received either a one-hour introductory or a 16-hour intermediate course in SPC. All first-line supervisors in the plant are now proceeding through a 40-hour advanced program with an emphasis on in-plant practical experience. Over 30 hourly workers who are serving as shop floor SPC coordinators have also

received a 40 hour advanced course in SPC. A small group of salaried specialists with responsibility for coordinating SPC in the plant have gone on to take three or more additional weeks of training in advanced techniques. The goal over the next two years is to give everyone in the plant at least 16 hours of SPC training.

Vehicle assembly plants, because they are less fertile ground for SPC, have been slower to introduce SPC training. However, the majority of assembly plants in Canada now have SPC training programs in place and most expect to train a significant percentage of their hourly and salaried people in SPC.

The independent parts industry has plans every bit as ambitious as those of the vehicle companies. Based on our survey of the independent parts firms, 53% of companies responding are aiming to have 80% or more of their workforce using SPC by 1990 (see Table 6.1). Another 25% of the companies expect 51 to 80% of their workers to be using SPC by 1990. To achieve these targets, the parts industry will have to provide most of its workforce with at least introductory SPC training in the next five years.

The survey also found that 63% of the companies responding had taught SPC to some hourly workers (see Table 6.1). Some 10% of the companies responding had taught more than half their workers -- no small achievement given the relative youth of SPC technology.

Interpersonal Skills Training

The need for heightened interpersonal skills within both management and the hourly workforce has increased significantly in recent years as worker involvement programs and production team concepts have begun to take hold in the industry. Even in plants with no formal worker involvement programs, we found growing efforts to encourage problem-solving in teams. The interpersonal skills required in these efforts include negotiating abilities, an understanding of group dynamics, agenda-setting,

Table 6.1

Extent of SPC Training To Date and Expected SPC Use in 1990 Among the Hourly Workforces of Independent Parts Companies

	Per cent of all Parts Companies	
Per cent of the Hourly Workforce:	Who Have Received SPC Training to Date	Who Will Be Using SPC In 1990
None	37%	8%
1-10%	24%	2%
11-30%	18%	11%
31-50%	11%	1%
51-80%	8%	25%
81-100%	2%	53%

Source: Task Force survey of the Canadian Independent parts industry.

brainstorming, group problem-solving communication and presentation abilities, and knowledge of basic psychological principles. Very few employees from either management or the hourly ranks come to the industry with much knowledge or experience in these areas. The industry is meeting the challenge of providing them with instruction.

Many companies try to package interpersonal training in short 8- or 16-hour courses that touch on most aspects of group dynamics. Some firms also provide specific instruction in communication skills -- often as packaged courses from outside vendors like Dale Carnegie. For managers the instruction is often integrated into general courses on how to be a good supervisor. On the whole we found that companies provide their own interpersonal skills instruction or buy it from the private sector. Very little use seems to be made of public educational institutions in this area.

It is difficult to estimate how much interpersonal skills instruction will be required over the next five years or even how much has been done to date. Companies that have experimented seriously with problem-solving teams or quality circles say that adequate interpersonal training is critical to their success. But most firms find it difficult to justify introducing such programs on a plant-wide basis when they are experimenting with team methods in only a few areas. The tendency in most plants is to provide the training only to those people actually involved in new work methods, even though managers agree that all employees could benefit from improved interpersonal skills. An exception is during product changeovers when an entire plant is shut for a time. Many firms have used such respites from the day-to-day pressure of production to give interpersonal skills instruction to all workers. Such instruction can be especially useful when the intention is to reopen the plant with a new management approach based on group problem-solving and decision-making.

Technical Skills Training

Technical skills is the area where the automotive industry has traditionally provided the greatest amount of on the job and institutional training. That will continue to be true despite the greatly increased training efforts in the skill areas just described. Technical skills training comes in many forms. It includes basic apprenticeship training in skilled trades, upgrading and refresher courses for already certified journeymen, equipment-related training for operators and repair and maintenance people, and a variety of courses in the skills necessary for specific jobs. We consider each of these in turn.

Apprenticeship training has always been an important part of the auto industry's strategy to assure itself of adequate numbers of skilled trades people. Most of the larger companies in cooperation with the UAW-Canada sponsor apprenticeships in occupations such as electricians, trade machinists and tool and die makers. These apprenticeships last from 2 to 5 years during which about 90% of the training takes place on the job and 10% in the classroom. Total apprenticeship training numbers are not available for the industry, but each of the largest firms has a program of some kind.

We estimate that between 300 and 400 skilled trades people are currently enrolled as apprentices in the industry.

Skills upgrading for journeymen is a constant challenge for the industry and will be all the more so over the next five years as computerization of the shop floor becomes ever more extensive. The most pressing need for upgrading is in the electronics area. All the repair trades, but especially electricians, are having to become adept at maintaining a variety of microprocessor-based equipment. In many cases this requires not only an understanding of electronics but also simple programming skills. Electronic diagnostic tools are beginning to simplify some of the repair jobs, but new skills are often needed to make use of such tools.

The extent of skills upgrading for journeymen now under way is hard to estimate, but most large companies now have formal programs. In the main, they are provided by outside sources such as private vendors, corporate training institutes and community colleges. In some cases companies have designed their own programs, but the cost per trained person of developing custom courses is high unless a company has many skilled trades people over which to spread the cost.

Despite the increased level of skills upgrading going on in the industry, we found that individual skilled trades people in several plants often feel not enough upgrading of skills is being done. Typical of comments from those interviewed was one from a veteran electrician in Windsor, "The company thinks it's providing enough training because we get a course here and there. It's not nearly enough. I've tried on my own to read [electronics] textbooks at night and take courses. But the colleges and universities are more useless than the company. They're all about five years out of date." An electrician at another plant noted, "A few of us get a little training when a new piece of equipment comes in. But mainly we get nothing. The company says it can't afford to retrain us all. Then they wonder why no one can fix some of the new machines." Companies, too, echoed the complaint that they could not afford as much skills upgrading as they need, but expanded training budgets are helping them make some headway.

Equipment-related training has also increased in recent years. As more sophisticated and highly automated machines are installed on the factory floor, they generally require specialized training for operators and repair people. Training is often supplied by equipment vendors, usually in the form of short 8-or 16-hour courses. Many companies now require vendor training as an integral part of any equipment purchase. Initial training may be by vendor staff, but usually manuals and sometimes videotapes are left behind for refresher study and teaching new workers. Increasingly, companies are using self-paced computerized learning programs like Control Data's Plato to teach equipment repair and maintenance. Machine simulators are employed to allow students to deal with the actual situations they will face on the factory floor. Ford's Essex Engine plant in Windsor, for example, has a library of such tapes as well as several classrooms with simulator equipment in its central learning centre.

Other specific skills training includes a range of courses on subjects such as computer terminal operation and training in gauge repair. Much of this training is centred around the skills necessary for a particular job. However, some technical skills are becoming so widely used in most plants that a cross-section of workers from various occupations need to learn them. These include skills like gauge reading, computer terminal operation, metric measurement, and blueprint reading. Supervisors require similar new skills, as well as additional skills such as operating personal computers. Secretarial and clerical staff are also being given formal training in word-processing and computer skills.

Most companies are providing such training on their own. In many cases they use the outside resources of private vendors and community colleges to help set up the initial curriculum. Then hourly workers are trained as trainers to teach other hourly workers. This approach is also being tried with SPC and interpersonal skills at some plants. It appears to be quite effective to have hourly people teaching each other, provided the trainers have been given adequate training.

Other Kinds Of Training

In addition to extensive job-oriented training programs, the auto industry offers many other kinds of courses. Labour and management have long cooperated in health and safety training, which has increased steadily during the past decade. The UAW and the major vehicle companies are implementing an industry-wide program to provide 40 hours of health and safety training to each skilled trades worker. Companies are also using product awareness training to teach all employees about the product they are making. This may include product demonstrations and, in the case of finished vehicles, even visits to dealers. Some companies hold classes on the company's goals and performance relative to competitors. At some plants the UAW also provides a short course on the role and history of the union. Many of these courses are packaged with interpersonal skills training as part of general orientation courses for new employees.

In addition to their organization-oriented programs, many companies offer personal improvement classes in everything from time management to handling work- and family-related stress. Many of the larger companies reimburse the cost of tuition for employees who take college or university courses related to their jobs. Increasingly, the industry has been willing to encourage and sponsor a wide range of educational activities as the benefits of such training for corporate performance have come to be recognized.

DELIVERING ON THE REQUIREMENT

Developing, coordinating, and delivering all the training the industry needs to remain competitive will be a massive effort. It will also be very costly. We have tried to determine just how massive and costly. Estimating training costs is no easy task. In the first place most training is still informal and takes place on the job. It is impossible to put a cost figure on such training, but it does have real costs in terms of lost work time, extra supervisory personnel and utility people to train new workers, and slower response times to repair machines and equipment. Even the costs of formal instruction

are difficult to estimate, because many companies do not keep track of such costs; when they do, many leave out the cost of lost work time and very few allocate proportionate overhead costs to training. Nevertheless, we have tried to make an estimate of the out-of-pocket costs of formal training programs in the industry -- in other words, the total cost of off-the-job training.

Our estimate is that total formal training costs in the industry last year were about $75 million and are likely to rise 2½ times, to $200 million a year in constant dollars, by 1990 if employment levels remain high.[1] Last year's $75 million a year in formal instruction costs represents an average of 15 hours of training per employee (hourly and salaried) across the industry. By 1990 that average is likely to rise 2½ times to 40 hours per employee per year. This does not mean all workers will receive 40 hours of training. A small percentage of workers will probably receive much more and many could receive less.

Our estimate of an average of 40 hours of training per employee by 1990 may in fact be conservative. General Motors of Canada, for example, is planning for 80 hours of annual formal instruction for skilled tradespeople (15% of the hourly workforce), and 40 hours annually for other hourly workers. Salaried staff can expect to have upwards of 80 hours annually as well. Similar targets were mentioned in interviews with other vehicle and parts companies.

1. Our estimate is derived as follows. We conservatively estimate the cost of an hour of hourly worker training to be about $40.00. This is based on an average Canadian automotive hourly range of $18.00 plus $16.00 in course development and staging expenses and $6.00 for inefficiencies related to covering for workers away at training. GM actually estimates that its training costs for each hourly worker are closer to $50.00 an hour. Salaried training costs are also somewhat higher. However, we have checked our $40.00 an hour estimate against a number of plant training budgets and found it reasonable. We have estimated that the industry last year provided an average of 15 hours of training per employee. This is based on individual interviews with each of the major vehicle companies and the responses to the survey of the independent Automotive Parts Industry. Thus, we estimate current training costs by multiplying 123,900 total auto employees x 15 hours of training each x the $40.00 hour cost = $74,340,000 or approximately $75 million. The 1990 estimate was derived by using the same employment and cost figures but 40 hours of training per employee which, based on our research, is a conservative estimate. Of course, industry employment in 1990 could be higher or lower than today, but given that our 40 hours of training per employee is a conservative estimate in 1990, we believe our overall estimate of $200 million in training to be accurate. Moreover, individual interviews with companies corroborate that most are expecting their training budgets to double or triple by 1990 in real terms.

The extent of training varies among companies, but overall levels in the industry are well above the amounts of previous years. Ford, for example, which has a decentralized approach to training, has seen most of its plants step up training significantly in recent years. A few parts facilities are already offering more than 20 hours of training per employee. GM has seen its overall level of training rise dramatically -- to 800,000 hours in 1984, which amounts to almost 20 hours per employee (see Table 6.2). GM estimates that it needs to do nearly 2,000,000 hours of training per year between now and 1990. Based on cost estimates, that would cost GM roughly $80 million a year. To give a clear idea of its scope, 2,000,000 hours of training a year would be twice the total amount of training at an average community college.

Other vehicle and parts firms have their own ambitious plans. Chrysler, which sponsored 74,600 hours of training last year, is adding an additional 14,000 hours of SPC training next year. With government assistance, Chrysler spent more than $3 million to retrain its entire workforce for the advanced technology installed at the main Windsor mini-van plant when it was refurbished during 1982 and 1983. AMC/Renault is planning for a similar massive training program for its workforce when its new Brampton plant is completed.

The independent parts industry has greatly increased its spending on training. Many firms responding to our survey noted that until recent years they offered little or no training to most of their workforce. All told, we estimate that the companies responding to the survey sponsored 708,000 hours of training among their 52,000 workers, for an average of 14 hours of training per employee. About 30% of hourly workers in the independent parts industry had received some training in the past two years, and each of these workers had received an average of 13 hours[2] of training over the two-year period. Salaried workers fared better, with 35% of their number getting an average of 50 hours[2] of training over the last two years.

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2. These averages do not correspond to those in Table 6.2 because they are over a two-year period.

Table 6.2

Extent of Training in the Major Vehicle Companies and the Independent Parts Industry in 1984

	Estimated Total Hours of Training Provided	Average Hours Per Employee
GM	800,000	20
Ford	NA	5-22*
Other Vehicle Companies**	71,000	5
Independent Parts*** Industry	708,000	13

* No overall average available. Range is rough estimate of levels in individual plants.

** Includes Chrysler, AMC/Renault, International Harvester, Kenworth, and Mack Trucks.

*** This is an estimate based upon the Task Force survey of the Independent Parts Industry. The total employees of all the firms responding to the survey was 54,900. Though all of the firms made automotive parts, some would not be included under SIC 325.

Source: Company interviews and the Task Force survey of the Canadian Independent parts industry

Throughout the industry, companies are formulating their training strategies for meeting the requirements of the new automotive world. As they do, many wonder how they will pay for all the additional training needed. Of the $75 million spent last year on training, we estimate that 30 to 40%,[3] or approximately $23 to 30 million, was spent on trainers, fees, course development, and various expenses associated with staging the actual training; the remaining 60 to 70% of costs represented the wages of those being trained and the expenses associated with replacing them at work. Traditionally, the industry has carried most of the cost of upgrading knowledge and skills on its own, although in recent years the government has often assisted. As the total cost of training approaches $200 million, the industry will be increasingly anxious for government to play a bigger role.

3. Based on breakdowns in individual company training budgets.

THE ROLE OF GOVERNMENT

The activities of government in industrial training and education are pervasive and varied. The public school system is the foundation of all skills development in society and as such constitutes, along with colleges and universities, the basic infrastructure for most industrial training. Increasingly in recent years, the federal and provincial governments have encouraged colleges and universities to forge closer links with industry and to support company training efforts more directly, especially in areas like course development and the training of instructors.

In addition to its role in providing the basic education and training infrastructure, governments have increasingly recognized that there is a public role to play in subsidizing industry training efforts financially. The main rationale for such funding has been that corporate investments in skills training are not always easily recovered because employees can leave at any time and join new firms, carrying their new skills with them. Such training benefits society as a whole but not necessarily the individual firms that financed the training. Hence, it can make good public policy sense to subsidize industrial training, recognizing it as a public as well as a private investment. In recent years this rationale has been allied with growing recognition of the critical importance of training as a strategic weapon in international industrial competition. Governments are concerned that industries remain up to date and competitive; increasingly, as we have seen in the automotive sector, that requires much greater expenditures on training.

Numerous government programs have been created at both the federal and the provincial level to assist industry in its training efforts. All these programs have major restrictions in terms of both the kinds of training that can be funded and the total amount of training dollars available to any individual company. As a result, the programs are not always used by automotive companies; even when used they often account for only a small portion of total training costs. Nevertheless, they have contributed to defraying some of the costs of training. The seven main government programs that have funded training in the industry in recent years are listed in Table 6.3. Four of the programs are federally funded, although administered jointly with the

provinces in some cases, and two are offered by the Ontario government, and one by the Quebec Government.

In terms of funding, the largest of the six programs in Table 6.3 has been the General Industrial Training Program which funded $9,318,000 worth of training in the auto industry between 1980 and 1984 in support of 3,280 workers. About 72% of the funds went to the automotive parts industry, mainly because the single company limits severely restrict assistance to the large vehicle firms like GM. About 10% of the total funds directed to the auto industry under the program have gone to the Quebec auto industry.

Ontario has also provided significant training funds to the industry over the last five years under the Training in Business and Industry Program (TIBI). All told, about $2.5 million has been provided, benefiting nearly 18,000 workers. A major new program, the Automotive Parts Investment Fund, was started in 1984. It lends low-cost money up to $750,000, to independent parts firms for modernization and product development projects that will raise productivity and quality in the industry. A 15% reduction of the loan principal may be granted to defray approved training costs associated with the project when an employer has submitted a satisfactory Human Resource Plan and has certified that the training has been carried out. To date 39 loans totaling $20.8 million have been approved; $3.1 million (15%) of these loans could be forgiven against costs incurred training the 1,746 workers involved in the projects.

Until recently, the Quebec Government offered no specific automotive training programs. Efforts were mainly concentrated in "ad hoc" programs or were related to the maintenance and repair of automobiles. In recent years however, Quebec has developed college-based technical programs related to the needs of the automotive industry in such areas as plastics, composites, mechanical engineering, and automated systems. All of these are offered by the 46 Cegeps and the Ordinique Institute.

At the secondary level the Quebec Department of Education is making great efforts to establish a Modular Training Plan, an adult-oriented program aimed specifically at satisfying labour market needs. At the same time, a Motorized Equipment Centre of Excellence is being established in Montreal that will provide a

direct tie between workers and the world of education. At this centre all documentation, training material and equipment will be kept up to date by the manufacturers themselves. For industry directly, Quebec also recently launched a new program "Support to Training in the Enterprise". It is targeted at small and medium-size businesses and so will be of particular help to the parts sector.

Quebec is aware of the changing needs of the automotive industry and its employees, and is moving aggressively to address these needs. The level of resources committed to training in the industry and to industrial training in general will increase in the coming years in response to the demands of technological change and changing management-labour relation requirements.

In addition to the programs run through government ministries, there is one other area of government training assistance to the industry -- the Ontario Centre for Automotive Parts Technology. Established in 1982, the Centre was founded to serve the independent parts industry with training, manufacturing consulting, technology development, and marketing programs. In its training role in 1984 it delivered 3,300 person-days of in-plant training at 86 plant sites and 1,900 person-days of seminar and workshop training. Of the in-plant training, about 70% was in SPC; the remainder was in areas like quick tool and die change, just-in-time production methods, and worker involvement. In addition to formal classes, consultants from the Centre work alongside company employees teaching them how to implement new manufacturing techniques. All told, the Centre spent about $1.2 million last year on manufacturing consulting and training of this type out of a total Centre budget of $4.4 million. Companies are required to cover a portion of the Centre's costs, but over 50% of the total cost of services is paid for by government funds. To date the Centre has been the most important public source of SPC training for the industry.

Table 6.3

Major Government Industrial Training Programs and Their Support for the Automotive Industry

Programs	Training Goals	Total Training Funds to Auto Industry 1980-84*	Number of Workers Trained 1980-84
General Industrial Training** (Federal/Provincial)	Train middle- and high-skill employees in nationally designated priority occupations	$9,318,000	3,280
Industrial Labour Adjustment Program** (Federal)	Promote industrial adjustment in hard-hit industries and communities through retraining and other activities	$651,000	434
Institutional Training (Federal/Provincial)	Basic academic & skills training in full-time educational institutions	NA	NA
Skills Growth Fund** (Federal)	Fund capital costs of specialized public training facilities	NA	NA
Training in Business and Industry (Ontario)	Provide skills upgrading especially in advanced technology	$2,531,000	17,938
Automotive Parts Investment Fund (Ontario)	Fund training in support of productivity and quality improvement projects in independent parts industry	Program started Fall 1984 ($3.1 million maximum allowable training assistance -- 15% of loan approvals to date)	Program started Fall 1984 (39 loans already approved - 1,746 projected trainees)
Support to Training in the Enterprise (Quebec)	Fund training by small and medium-sized businesses	Program started Fall, 1985	Program started Fall, 1985

* In accumulated current dollars

** Soon to be replaced by the recently announced Canadian Jobs Strategy

Sources: Special analyses by CEIC and Ontario Manpower Commission

Industry Perception of Government Assistance

Although the industry is appreciative of the level of government training assistance to date, most companies would like to see much more assistance forthcoming. To put the government contribution into perspective, consider last year's industry training costs. We estimate that direct federal and provincial training assistance to the industry last year totaled roughly $4 million.[4] This amounts to only 5% of the total estimated industry training costs of $75 million. With those costs rising quickly to the $200 million range by 1990, it is not surprising that many auto companies are anxious to have the government take a bigger role in funding training.

The Task Force also found that many firms were not actually taking advantage of the programs that already exist. There are several reasons why automotive companies are not making greater use of government funds. In some cases companies are not aware of the programs or do not realize that they qualify for funding. In other cases the programs are too restrictive; they do not cover the kind of training the company needs or have funding limits so low as not to be worth the trouble to apply. Sometimes lead times are too long to make waiting for funds worthwhile, and training funds can rarely be applied for after the training has taken place.

To understand better what has worked and what has not worked in government assistance, companies responding to our survey of the automotive parts industry were asked to review their experience. Some 57% of those responding to the survey had used government training assistance in the past two years (see Figure 6.2). Of these

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4. Canada Consulting Group estimates based on CEIC and Ontario Manpower Commission internal analyses of training program funding.

firms, 82% felt the level of funding was helpful and 66% found the aid relevant to their needs. But fewer than half believed restrictions and lead times were reasonable. This gives credence to the suggestion that excessive restrictions may limit the usefulness of some programs.

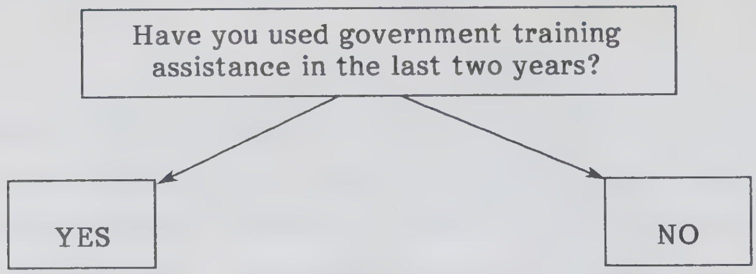
Of the 43% of firms that had not used government training assistance, about half said one reason was because it was not relevant to their needs. Fully 30% felt there were too many restrictions and 18% said too much lead time was required. Interestingly, 24% of those that did not use government assistance said it was because they had no exposure to available programs. This was corroborated in interviews where many managers confirmed that they would be interested in government assistance but were not aware that appropriate programs were available. Others said they found the whole government training program area a morass of puzzling acronyms and confusing guidelines. One parts plant manager said the best thing the government could do before spending another training dollar was to put together a simple guide to federal and provincial training programs.

Companies are also concerned that government training assistance does not go far enough. In particular, there are few programs that will cover the cost of SPC training or indeed any analytical or interpersonal training. Most of the existing programs are tailored to training in specific occupations. Companies are concerned as well that overall levels of funding are too low. As the industry prepares to increase its training levels two- to three-fold, companies wonder whether governments are prepared to follow suit.

The federal government is in the process of developing guidelines for training under the Canadian Jobs Strategy announced by the Minister of Employment and Immigration this past spring. Many programs like General Industrial Training, ILAP, and the Skills Growth Fund will be subsumed under the new initiative. There will be six new programs, and at least three could be applicable to the auto industry: the $100 million skills investment fund, the $50 million skills shortages program, and the $100 million innovations fund. On the face of it, however, many of the old problems may remain. Training will continue to be occupation oriented, and overall funding levels in these three programs may in fact be lower than funding for the programs they replaced.

Figure 6.2

Independent Parts Industry Use of and Experience with Government Training Assistance



57% of all firms		43% of all firms	
Experience with Assistance Among The 57% That Have Used It		Reasons for Not Using Among the 43% Without Assistance	
Helpful level of funding	82%	Not relevant to needs	49%
Relevant to needs	66%	Too many restrictions	30%
Reasonable restrictions	45%	No exposure to available programs	24%
Reasonable lead times	40%	Too much lead time required	18%
		Insufficient level of funding	10%
		Applied for but turned down	3%

Source: Task Force survey of the Canadian Independent Automotive parts industry

A final area of industry concern with regard to government's involvement in training is the role of the community colleges and universities. In our interviews we often heard criticism of colleges and universities for not providing relevant high-quality courses. Almost none of the community colleges are seen to have adequate SPC training programs and the few that do only instituted them very recently. Most companies have turned to private vendors, the Ontario Centre for Automotive Parts Technology, or U.S. universities and colleges for their SPC and related training. Some of the problems may have to do with poor communication between the industry and

educational institutions. The industry has to do a better job of communicating its needs and concerns to the educational establishment.

There is also concern in the industry that the colleges and training schools are not keeping up with developments in electronics, a specialty that is critical to all the new technologies. To be sure, it is difficult for any one school to be up on all new developments. But as several managers suggested, it should be possible to have at least one centre of excellence somewhere in the country for each critical subject area. At the very least such centres could focus on curriculum design and develop standard courses that could be used directly by the industry. Again, the industry would need to make the effort to participate in these centres, even if only in an advisory capacity. This participation would have to go beyond passive membership on a board or committee to active consultation between key industry contacts, including even first line supervision if necessary, and the institutions' instructors. Board membership has all too often led to unsatisfactory communication of the needs of industry to those actually doing this training.

THE NEED FOR HUMAN RESOURCE PLANNING

The challenge of assuring an adequate supply of skilled workers in the automotive industry is two-fold. On one hand it requires large efforts to upgrade the skills of the existing workforce and keep them current in the latest skills needed for automotive production. On the other hand it requires careful planning to ensure that appropriately skilled workers are available for staffing positions that become open. This kind of planning around staffing requirements is called human resource planning. It can include training activities, but its broader goal should be the proactive anticipation of future workforce requirements and the satisfying of those requirements with appropriately prepared staff.

As overall skill requirements in the auto industry increase and as the demand for some occupations rises dramatically while the call to others shrinks, the need for good

human resource planning will grow apace. Because of its cyclical nature, the automotive industry has always had difficulties forecasting its occupational needs. In times of rapid industry expansion, as over the past two years, skill shortages can seem endemic. Once a contraction sets in, an oversupply of many kinds of skilled workers is often equally evident. Even if a contraction occurs over the next five years, however, there will still be difficulties finding certain types of skilled workers.

The Extent Of Skills Shortages

In the last chapter we described the occupations that are likely to expand most quickly over the next five years. Heading the list were skilled trades people, especially electricians. The demand for most semi-skilled workers was projected to increase slightly as a percentage of the total workforce, and the number of unskilled workers was expected to decrease slightly as a portion of the total workforce. The industry expects little difficulty in hiring semi-skilled and unskilled workers. However, concerns are already being raised about the difficulties that could be experienced in hiring skilled workers. The industry's experience of the last two years gives reason enough for concern.

Many companies have experienced difficulties hiring adequate numbers of skilled workers since the recession, though the problem is more acute in the independent parts industry. Each of the major vehicle companies has reported difficulties in recruiting skilled workers at one or more of its plants in the last three years. These difficulties are mitigated somewhat for the vehicle companies by the fact that their pay scales are the highest in the auto industry, making it possible to attract skilled workers from other firms. The major vehicle companies also use formal human resource planning to project the skills required and worker availability in advance of actual needs. With the exception of plant openings or major expansions in capacity, the vehicle companies rarely find themselves in the position of endangering production for want of appropriately skilled workers.

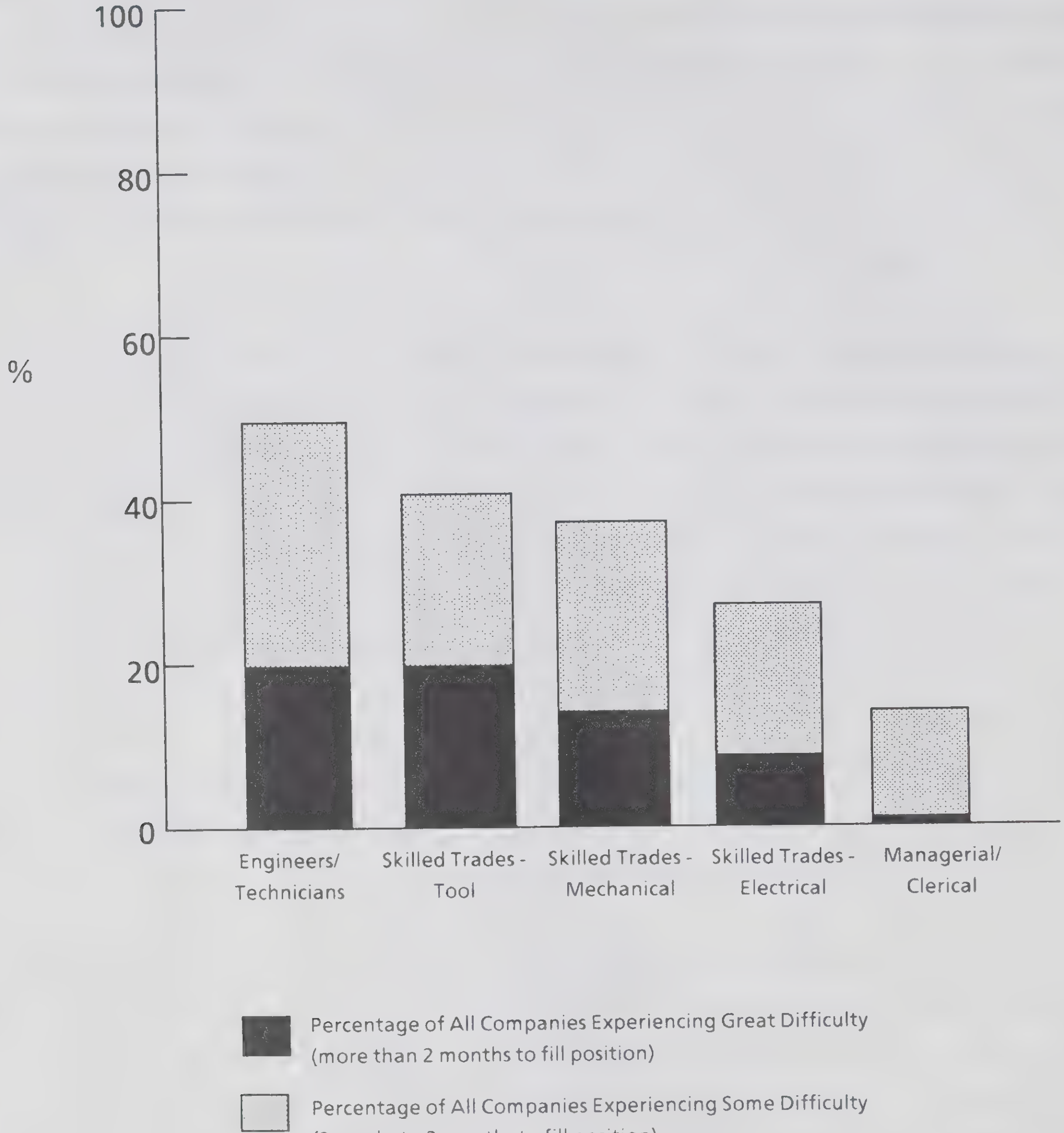
The independent parts industry, on the other hand, has experienced many difficulties hiring skilled workers; at times this has led directly to losses in production. In Figure 6.3 we present the five occupations where independent parts firms have had the most difficulty recruiting workers. The greatest difficulty has occurred in hiring engineers and technicians; 19% of respondents reported they had great difficulty in hiring (more than two months to fill a position), and another 29% had some difficulty in hiring (two weeks to two months to fill a position). The situation with respect to skilled trades people in the tooling area is only slightly better. Of companies responding to the survey, 20% experienced great difficulty and 21% experienced some difficulty in hiring tooling trades people.

Surprisingly, the number of firms having difficulties hiring mechanical trades people, such as machinists, mechanics, pipefitters, and millwrights, was higher than those having difficulties hiring electricians. While 37% of all firms had some or great difficulty hiring mechanical trades people, only 31% had some or great difficulty hiring electricians. Among firms over $100 million in sales, 54% reported some or great difficulty in hiring electricians. Given the sharply higher demand for electricians to 1990, this will be a critical area to watch. It is entirely possible that the large companies have experienced the influx of electronic technology more extensively than smaller firms and so have had a much greater need for electricians -- especially those with electronics capabilities. As electronic technology becomes more widespread among medium-sized and smaller firms, they may find it increasingly difficult to obtain adequate numbers of skilled electricians.

The only other occupational category where more than a handful of independent parts firms experienced hiring difficulties was in the managerial and clerical area. Of all companies responding, 15% had had at least some difficulty in hiring managerial or clerical people. In this case larger companies experienced less difficulty than the average firms; only 8% of firms with over $100 million in sales experienced any difficulties hiring managerial or clerical staff. In other occupations surveyed, including most semi-skilled and unskilled designations, only a few companies reported any difficulties in hiring. With the steady to slightly declining demand expected for these occupations to 1990, hiring adequate numbers should remain relatively easy for most companies.

Figure 6.3

Percentage of Respondents to the Independent Parts Survey That Have Experienced Hiring Difficulties in Selected Occupations During the Last Three Years (% of companies)



Source: Task Force survey of the Canadian Independent parts industry

For some of the independent parts firms surveyed the difficulties in hiring skilled workers resulted in curtailments of production. Of all the firms responding to the parts survey, 10% reported that they had curtailed their operations at least once in the last three years because of a shortage of appropriately trained personnel.[5] These firms were spread across all size categories. Most of these companies experienced a loss of less than 10% of total production at the time, with the length of time production was curtailed more than over 25 days in most cases. In a few cases, however, the absence of adequately skilled personnel was devastating. One firm lost 50% of its production for several weeks. Another lost 10% to 20% for several months. The lack of skilled workers meant a significant loss of production that could not be made up later.

The Extent Of Human Resource Planning

To meet the skills demand of the next five years and avoid the potentially devastating effects of skills shortages, automotive companies will need to plan their human resource requirements carefully. In some cases this can be done fairly informally. In small firms the owner/manager may know the workforce personally and can often predict fairly accurately the number of workers that will quit or retire in the next year and plan the firm's recruitment strategy accordingly. In larger firms, however, there is often a need to formalize the human resource planning process to ensure that adequately skilled people will be available as needed.

A formal human resource planning process will usually have three components:

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5. These figures compare very closely with results of a special 1984 survey undertaken by the Ontario Manpower Commission and CEIC. Among the 39 automotive parts firms (SIC 325) that responded to their survey, 15% claimed they had curtailed production capability because of the unavailability of appropriately trained personnel. Among these firms the estimates of production lost due to such curtailments ranged from 5% to 30% of total production at the time.

- Projection of Staffing Requirements, including projections of sales, equipment, and process changes and attrition rates.

- Monitoring of Availability of Workers, including the monitoring of in-house skill inventories, training-in-progress, and the availability of qualified new hires.

- Matching of Requirements and Availability, including training plans, layoff policy, and researching of other sources for qualified new hires where potential shortfalls have been identified.

According to this definition, human resource planning is widespread in the vehicle companies but not in the independent parts industry. The major vehicle companies have formal human resource planning processes, as do several of the smaller companies. In some firms planning is done at the plant level, but in certain critical areas, such as skilled trades, planning is also undertaken on a company-wide basis. At most of the vehicle firms, formal planning is confined to those occupations considered to be in short supply or where long lead times are required for training or hiring.

In the independent parts industry, however, formal human resource planning is not nearly as common. Only 30% of the companies responding to our survey indicated they had a human resource planning process as defined above (see Table 6.4). Larger parts companies, though, are more likely than the vehicle companies to have such a process, with 77% of firms with sales over $100 million indicating they had a formal human resource planning system.

Of those with formal planning systems, 16% said they had begun only in the last year, another 20% said they had started within the last two years, indicating the growing interest in such human resource planning. Most of those that did planning -- 80% -- looked forward two or more years in their planning process, indicating that even in a cyclical industry, most are trying to make long-term plans.

The 70% of companies that do not do formal human resource planning gave a variety of reasons for not having formal plans. The most common reason, given by 56% of those that do no formal planning, was that they generally had no trouble finding

Table 6.4

Extent of Formal Human Resource Planning in the Independent Automotive Parts Industry

	Do you have a formal human resource planning process?*	
	Yes	No
Companies Under $1 million in Sales	19%	81%
Companies $1-20 million in Sales	24%	76%
Companies $20-100 million in Sales	29%	71%
Companies Over $100 million in Sales	77%	23%
All Companies	30%	70%

* A formal human resource planning process is defined in the text.
Source: Task Force survey of the Canadian Independent parts industry.

workers.[6] The second most common reason, given by 38% of firms without a formal planning process, was that it is too difficult to forecast requirements for workers. Another 12% said it was too difficult to forecast the availability of workers. It is important to emphasize however that among those parts firms that do not have a formal human resource planning process, the majority do attempt to make rough projections of workforce requirements based on, for example, sales forecasts, equipment and process changes, and attrition rates.

6. This is entirely consistent with our earlier finding that many firms had difficulty finding adequate workers in certain key skilled occupations. Those firms that said they had no difficulty finding workers constituted only 39% of our total sample of parts firms, and the highest level of hiring difficulty experienced was 48% of all firms, in the engineers and technicians category. Thus, these 39% of firms could easily be among the 52% that experienced no difficulty in hiring engineers and technicians.

While appreciating the difficulties inherent in any formal human resource planning exercise, the relatively low level of such formal practice in the industry helps explain the hiring difficulties reported in Figure 6.3. The public institution cannot be expected to be instantly responsive to the skill requirements of the industry if for no other reason than the time it takes to put people through training programs. Further, these institutions cannot be expected to produce 100% job-ready employees: the higher the level of skill required, the more likely it is that some significant proportion of the skills required to be proficient on the job will be relatively employer-specific. Hence, in-house human resource planning has to be an important component of maintaining one's competitive edge.

The assemblers also reported that human resource planning was also essential to meeting their goals for equality in the workforce: the push, for example for skilled tradeswomen involves promoting the opportunities to high school students years in advance of final qualification.

CONCLUSIONS ABOUT TRAINING AND SKILLS DEVELOPMENT

In this chapter we have discussed the tremendous challenge facing the automotive industry as it mobilizes to meet the skills requirements of the next five years. Greatly heightened levels of training and increased use of formal human resource planning will be necessary to meet those requirements. The industry, policymakers, and the general public must face a number of issues that emerge from our analysis of the training challenge. They include the following:

1. The existing industry workforce will be capable by and large of making the transition to the higher level of skills required in the future -- provided they have adequate training. All of the company strategies are predicated on an intensive commitment to upgrading skills, but they may not be able to afford to carry through on that commitment.

2. The industry is interested in discussing with government how the existing public training framework could be used to increase overall funding levels and to make a wider variety of industry training activities eligible for funding. The Motor Vehicle Manufacturers Association and others suggested that training tax credits might be a way to meet these needs outside the existing framework.

3. The industry will require new workers fresh out of school to have higher basic literacy and mathematical skills and would prefer more applied science as well. Again, discussions between the industry and government should help address these concerns.

4. Public higher educational institutions do not seem to be meeting the auto industry's needs and should devote more effort to keeping current on industry's requirements (e.g., SPC) and to delivering training on-site where most manufacturers and workers want and need it. The industry should attempt to communicate its training needs more fully to colleges and universities. In particular there should be joint exploration of the possibility of establishing centres of training excellence at selected colleges and universities.

5. The government, companies, and labour together should explore innovative alternatives to delivering on-site training -- especially to smaller firms.

6. Increased government/industry efforts to share course development costs among firms should be explored as a means of reducing overall training costs.

7. Federal and provincial governments should examine the use of training funds as an inducement to new automotive investment and, upon consultation with the industry, review the possibilities for such efforts in their jurisdictions.

8. Improving the mechanisms for private/public communication and training should be given high priority. As should be clear from this chapter, meaningful communication of needs and priorities will be a critical first step towards meeting the training challenge.

The training and skills challenge facing the industry is immense. Meeting it successfully will require the involvement of all levels of government, labour, and the companies themselves. Efforts like this Task Force can promote the process and identify opportunities, but much remains to be done.

CHAPTER 7

LABOUR MOBILITY IN THE INDUSTRY

Canada's automotive industry, one of the nation's largest employers, has also been a major training ground for other industries. Automotive jobs have provided training and skills development for thousands of workers -- many of whom have taken their acquired knowledge on to new jobs in other businesses. To gain a better understanding of this role of the industry and to ascertain the ability of the industry to adjust smoothly to different employment levels in the future, the Task Force asked the Canada Employment and Immigration Commission (CEIC) to undertake a special study of labour mobility in the automotive sector. This chapter summarizes the main findings of that work.

The CEIC study was based on a set of administrative data files assembled by CEIC for the purpose of labour market research. The study analyzed the experience of a 10% sample of Canadians that worked in the automotive industry (SIC 323 and 325)[1] between January 1972 and January 1983. To make the data drawn from this 10% sample reflect the real level of employment in the industry, we have multiplied all numbers by a factor of 10.

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1. SIC (Standard Industrial Classification) 323: Motor Vehicle Manufacturers
325: Motor Vehicle Parts & Accessories.

INTER-INDUSTRY MOBILITY

Workers are continually adjusting to changing economic circumstances and large numbers of workers change jobs every year. Figure 7.1 shows that the automotive industry employed 116,667 workers in 1978. Of these, 62% were still employed in the industry in 1983 while 38% had left the industry and for the most part were employed elsewhere. In addition, during the period 1978-1983, 92,240 workers entered the automotive industry. But many of these new workers were laid off as employment declined or left voluntarily to seek opportunities elsewhere. In all, 103,534 left the automotive sector during the five years under study.

The industry is a major source of first employment for many young people and others entering the workforce. Of the 92,240 people who entered the industry in 1978-82, 33,040 or 36% were taking their first full-time job. For these people the auto industry provided not only automotive skills but the basic employment skills associated with a first job.

Of those workers who left the industry in the years 1978-82, 84,160 or 81% had found work elsewhere by January 1983. About 4.5% or 4,640 workers were still on unemployment insurance at the end of the survey period. The remaining workers who left the industry had retired, emigrated, returned to school, or otherwise left the labour force. In this group also were some cases where data about what had happened after a worker left the industry were missing.

Focusing on inter-industry labour mobility, it is possible to look at the kinds of jobs workers had before coming to the automotive sector and after leaving. The bulk of new workers with a previous job came from the service sector -- 55% of entrants to the independent parts industry and 64% of entrants to the motor vehicle companies (see Table 7.1). This might be expected, given that the service sector accounts for such a large percentage of all Canadian employment.

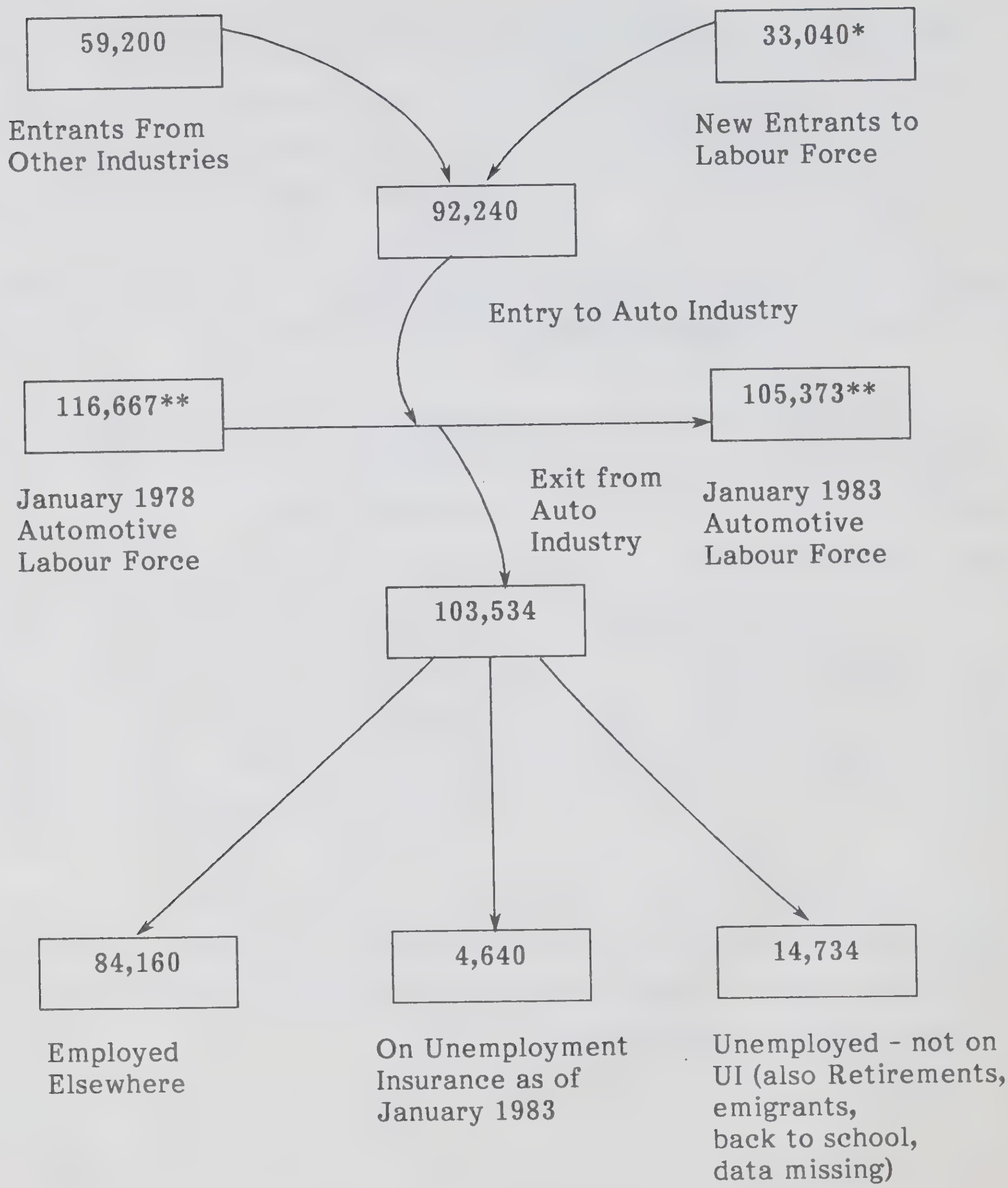
The proportion of new entrants coming from manufacturing jobs exceeded the proportion of manufacturing employment in the overall economy. Though the manufacturing sector employed only 18% of the labour force, 35.7% of all previously employed independent parts workers and 24.7% of all previously employed workers at motor vehicle companies came from manufacturing jobs.

Many people in the independent parts industry believe that the motor vehicle companies, with their usually higher wage scales, are able to hire away some of their most skilled workers. Although we were unable to test this theory for skilled workers specifically, the data show that only 1.1% of all employees leaving the independent parts industry for another job went to the motor vehicle companies. Most of these workers could, in fact, be skilled people trained by the parts sector, but there is clearly no evidence for a wholesale exodus of parts workers to the motor vehicle companies.

At first glance Table 7.1 appears to show that the flow of workers in and out of the independent parts and motor vehicle companies is closely balanced by industry sector. For example, 35.7% of all previously employed workers who entered the automotive parts industry came from other manufacturing sectors, and 35.5% of all those who were re-employed after leaving the industry went to other manufacturing jobs. However, it must be remembered that 36% of all entrants to the total automotive workforce had no previous job. (This is counterbalanced to some extent by the 22% who were unemployed or left the labour force when they left the auto industry.) In total the auto industry hired 59,200 workers from other industries between January 1978 and January 1983. It sent 84,960 workers to other industrial sectors (see figure 7.1). Thus, on average the auto industry sent 42% more workers to other industries than it received from them. Nevertheless, it is interesting that the distribution of entrants and exits by industry is so close in most cases. The parallel patterns are largely a reflection of the overall distribution of jobs in the economy.

Figure 7.1

Changes in the Canadian Automotive Industry Labour Force January 1978 - January 1983



* Includes all those who had never worked before and those who had worked only 20 weeks or less in a service sector job before joining automotive sector.

** Employment levels estimated on the basis of CEIC administrative data and hence differ slightly from Statistics Canada figures

Source: CEIC Automotive Labour Adjustment Study.

Table 7.1
Distribution by Industry of People Entering Or Exiting The Independent Parts and Motor Vehicle Industries

Industry Source/Destination of Entrants/Exits	Independent Parts Industry		Motor Vehicle Industry*	
	Entrants	Exits	Entrants	Exits
All Manufacturing	35.7%	35.5%	24.7%	19.1%
Motor Vehicle Companies*	2.9%	1.1%		
Independent Parts			2.1%	1.9%
Metal Fabrication	8.3%	6.0%	4.5%	2.9%
All Other Manufacturing	24.5%	28.4%	18.1%	14.3%
Resource Industries	3.9%	5.5%	2.3%	2.5%
Construction	5.3%	5.6%	9.0%	12.4%
Service Sector	55.0%	53.4%	64.1%	66.1%
Transportation & Communication	2.9%	2.5%	4.5%	3.9%
Public Administration & Defence	7.3%	4.2%	8.6%	8.1%
Finance, Insurance, & Real Estate	7.1%	9.6%	6.0%	9.3%
Trade	16.7%	19.5%	19.9%	12.8%
Commercial, Business, and Personal Services	21.0%	17.6%	25.1%	32.0%

* Includes only GM, Ford, Chrysler, and AMC/Renault.

Note: Data for entrants is drawn from 1978 and 1979. Data for exits is drawn from 1981 and 1982. Only those people entering the auto industry from another industry or leaving the automotive sector for another industry are included. These percentages are based only on data from Ontario.

Source CEIC Automotive Labour Adjustment Study

INTER-PROVINCIAL MOBILITY

A second aspect of the CEIC study looked at the degree of interprovincial mobility among the automotive workforce. By interprovincial mobility we mean those workers who either came to their automotive jobs in a particular province from locations outside the province or left their automotive jobs for locations in another province. The degree of interprovincial mobility in an industry is one measure of whether the labour market can adjust smoothly to employment dislocations brought on by plant closings or layoffs in an industry. If many displaced workers are willing to move to gain new employment, the labour adjustment process is likely to be easier.

The CEIC study found that there is a significant degree of interprovincial mobility in the automotive industry workforce, but that it is not very different from the level of interprovincial mobility in the manufacturing workforce as a whole. Between January 1972 and January 1983, 16% of all those who worked in the automotive industry in Ontario or Quebec[2] made at least one interprovincial move either to or away from a job in the auto industry (see Table 7.2). Actually, this group of movers was extremely mobile and made an average of 2.4 interprovincial moves each. These could be moves from a home province, say, Newfoundland, to an auto job in Quebec and then a later move back to the home province. They could also be two successive moves to different provinces, say, from Newfoundland to an auto job in Ontario and then on to Alberta.

Overall, this level of interprovincial mobility is not that different from the level in the manufacturing sector as a whole. In Quebec 14.6% of the 1,322,580 people who worked in the manufacturing sector at some point between January 1972 and January 1983 moved interprovincially either to or away from their jobs. In Ontario, 18.7% of the 2,933,120 individuals employed in manufacturing between January 1972 and January 1983 made at least one interprovincial move.

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2. Because the bulk of the auto industry is in Ontario and Quebec, we focused the interprovincial mobility study on those two provinces.

Table 7.2

Portion of the Automotive Workforce That Moved Interprovincially Before Or After Their Automotive Jobs, January 1972-January 1983

	Quebec	Ontario
Persons Who Worked in Autos Some Time in 1972-82	28,910	289,300
Number Who Moved Interprovincially at Least Once	4,630 (16%)	46,950 (16%)
Total Number of Interprovincial Moves	12,030	113,300
Total Incoming Moves	5,260	50,600
Total Outgoing Moves	5,860	62,700
Number of Moves Per Mover	2.6	2.4

Source: CEIC Automotive Labour Adjustment Study

The number of moves per mover in the overall manufacturing workforces in Quebec and Ontario were roughly similar to the automotive workforce averages. In Quebec each interprovincial mover in manufacturing generally made 2.9 moves on average; in Ontario each made 2.7 moves.[3]

Overall, the number of outgoing moves from each province's automotive industry was higher than the number of incoming moves (11% higher in Quebec, 24% higher in Ontario), suggesting that on balance movers were more often leaving for opportunities elsewhere. However, a close look at the proportion of moves on a year-by-year basis from 1972 to 1982 shows a fairly even distribution of total moves over the eleven-year period. There also is no direct correspondence between the success or failure of the automotive industry and moves in or out, which suggests that overall economic conditions outside the industry and especially in other provinces are at least as important as the automotive

3. All figures on interprovincial mobility in the overall manufacturing workforce are also from the CEIC Automotive Labour Adjustment Study.

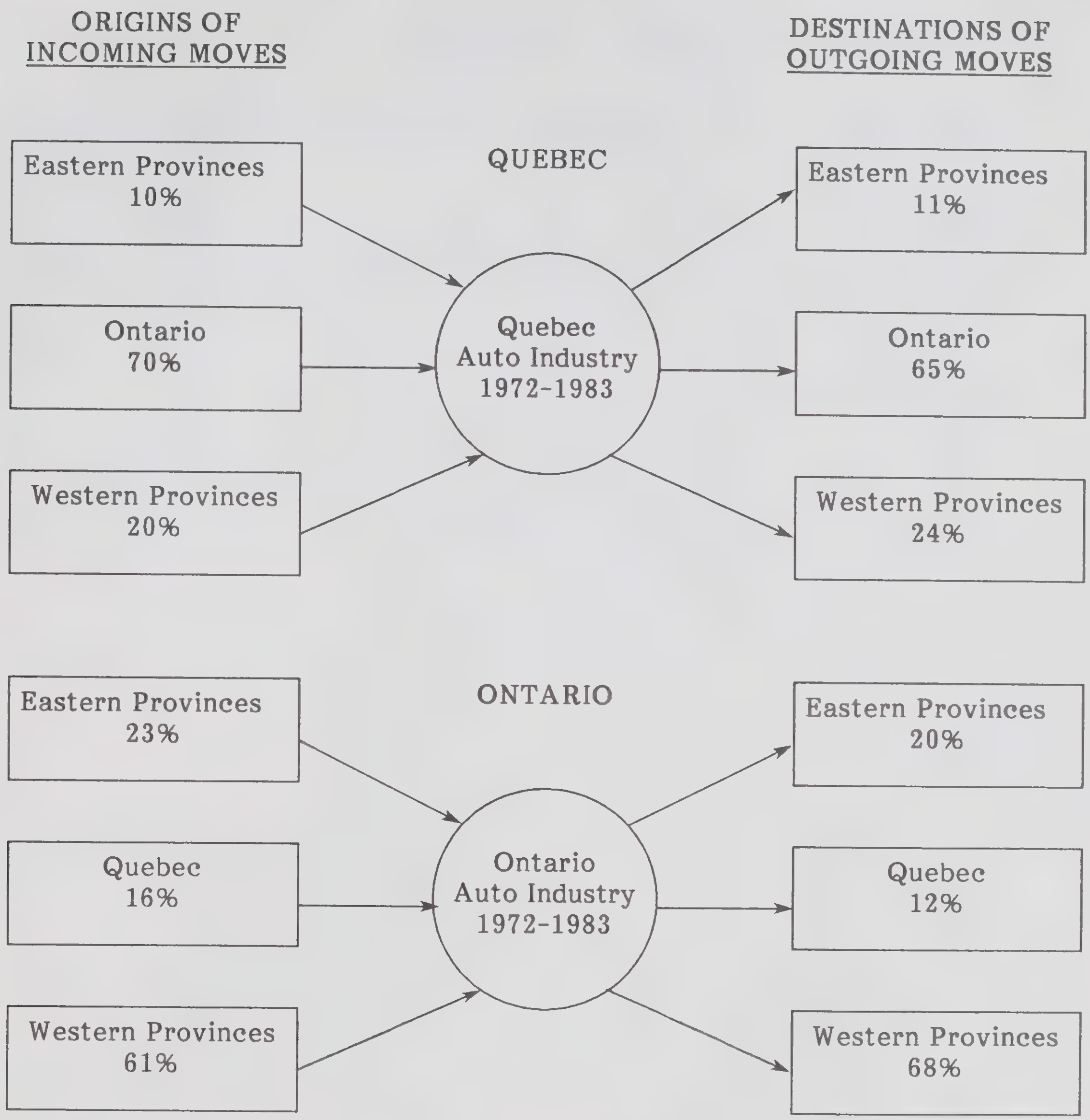
environment. For example, in 1979 there were almost twice as many interprovincial moves out of the Ontario and Quebec automotive industry as there were interprovincial moves into those industries. Given that most of 1979 was a good year for the automotive industry, the much greater outflow of workers suggests that buoyant economic conditions in provinces like Alberta were drawing workers away from automotive work that year.

The origins and destinations of those making interprovincial moves vary a great deal between Ontario and Quebec. In Ontario, 61% of the incoming workers came from the western provinces, 23% came from the eastern provinces, and only 16% come from Quebec. In Quebec, 70% of the incoming workers were from Ontario, 20% from the western provinces and 10% from the Eastern Provinces (see Figure 7.2). Moves out of province seem to parallel incoming moves in their distribution in both Ontario and Quebec. Most moves out of Ontario were to the western provinces, and most moves out of Quebec were to Ontario. In terms of overall mobility, 60% of all the interprovincial moves were between Ontario or Quebec and the western provinces, suggesting that a small but significant portion of the automotive workforce was willing to migrate a great distance.

A closer look at exactly who migrates interprovincially reveals, not surprisingly, that it is mainly young workers. Most of those who moved interprovincially before or after their automotive jobs were under 30 years old -- 62% in Quebec and 77% in Ontario (see Table 7.3). This compared to only 36% of the workforce in each province who were under 30 years of age and never moved. Even more dramatically, only 16% of those over 39 years old in Quebec and 6% of those in Ontario migrated interprovincially. On the other hand 30% of those in Quebec who never moved and 35% in Ontario were over 39 years old. It is decidedly the young who seem to have the least to lose and are willing to migrate. As we discuss in Chapter 8, it is also the younger workers that are most likely to be laidoff during industry downturns, a fact that may also help explain their greater mobility.

Figure 7.2

Origins and Destinations of Interprovincial Moves Into and Out of the Quebec and Ontario Auto Industries 1972-83



Source: CEIC Automotive Adjustment Study.

Table 7.3

Age Distribution of the Interprovincial Movers and Stayers In the Automotive Workforce in Quebec and Ontario 1972-83

	Quebec		Ontario	
Age Groups	Movers	Stayers	Movers	Stayers
Younger Than 20 Years	17%	2%	17%	1%
20-29 Years	45%	34%	60%	35%
30-39 Years	22%	34%	17%	29%
40 Years or Older	16%	30%	6%	35%
Total	100%	100%	100%	100%

* Movers constitute those in the automotive workforce who moved interprovincially immediately before or after their automotive jobs. Stayers constitute all other automotive workers.

Source: CEIC Automotive Labour Adjustment Study

MOBILITY WITHIN PROVINCES

A final aspect of mobility investigated by the CEIC study was movements within provincial labour markets. Specifically, the study examined the movement of workers into and out of three city-defined regions: Windsor, Kitchener, and Toronto. The percentage of workers in those regions who moved either to or away from the region where they held automotive jobs was higher than the interprovincial mobility rates cited previously. In the Kitchener region 34% of the automotive workforce had moved in to or out of the region. In Windsor it was 28% of the workforce and in Toronto 26% (see Table 7.4). However, the number of moves per mover was in the range of 1.3 to 1.4 -- much lower than in the interprovincial mobility data. This suggests that most people moving into the regions stayed in their new communities and most who moved out had been in the region for a significant period of time.

Table 7.4
Portion of the Automotive Workforce in Selected Ontario Regions Who Moved Before or After Their Automotive Jobs 1972-82

	Windsor Region	Kitchener Region	Toronto Region
Total Persons Employed in Autos Some Time In 1972-82*	42,210	29,690	88,900
Number Who Moved In or Out of Region At Least Once*	9,360 (22%)	11,510 (39%)	21,470 (24%)
Number of Moves Per Mover	1.4	1.3	1.4
Movers Who Move In or Out of Province	28%	34%	26%
Movers Who Moved Within Province	72%	66%	74%

* Numbers for all three regions are lower than actual because of missing district office codes on some records.

Source: CEIC Automotive Labour Adjustment Study.

IMPLICATIONS FOR THE INDUSTRY

Clearly, there is a significant amount of mobility in the automotive workforce. Between 1972 and 1982, an average of 17% of the workforce turned over each year.[4] This number is higher than the attrition rates reported by

4. This estimate is based on averaging the total turnover identified in the CEIC study across the whole period on an annual basis and then dividing by the average total employment for the period as reported by Statistics Canada. The 17% turnover number significantly exceeds the self-reported natural attrition rates of automotive companies which are generally in the 4-8% range. Part of the difference could be attributed to the fact that the Statistics Canada employment census misses firms with fewer than 20 employees. Even more significant could be the fact that layoffs and other involuntary terminations would not be reflected in corporate attrition rates. It would appear that even when employment in the industry is stable, many shifts in employment are under way as some firms grow smaller or close and others open or expand.

companies in the automotive sector, which are generally in the range of 4 to 8% . This suggests that even when total industry employment appears stable, the composition of the workforce is actually changing as some firms shrink or close while others expand and grow.

Our detailed analysis of labour mobility in the automotive industry reveals several important implications for the industry and for policymakers concerned with its workforce:

1. The industry is a major training ground for new workers in the economy. Between January 1978 and January 1983, when overall automotive employment levels were shrinking, the industry still gave an average of 6,600 people a year their first experience of full-time employment. The industry is thus not only a major provider of technical skills and experience but also an important source of basic job skills for many workers.

2. There is a significant degree of mobility in the automotive workforce both within and between provinces. Fully 16% of the workforce moved interprovincially before or after their automotive jobs, and many more moved within their provinces. This mobility indicates that should overall employment levels fall in the future, some workers would be willing to move to find new jobs.

3. It will be the young, however, that are most likely to move, and should employment declines result in layoffs of older workers, they may be less willing or able to move to find a new job because of their roots in the community, equity in a home, and similar factors.

4. The amount of mobility in the workforce re-emphasizes why the costs of training are not easily recovered by the companies that sponsor it. This portability of new skills is an argument for a larger government role in training.

In the following chapter we examine the possible future levels of employment in the automotive industry and the prospects for smooth labour adjustment in the event of employment declines. As we will see, the high degree of turnover and mobility in the automotive workforce will assist in smoothing adjustments in the overall level of employment, but they can go only so far. In the face of major employment dislocations, the societal and personal costs of adjustment will still be extremely high.

CHAPTER 8

HOW MANY JOBS?

The automotive industry is one of Canada's largest employers. One out of every twelve manufacturing workers is employed directly in vehicle and parts production. Another one in twelve works in supplier industries like steel or plastics and has a job that is dependent on the auto industry.

Since 1982, Canada's auto industry has led our economic recovery, creating 21,000 jobs directly in automotive production and another 24,000 jobs in supplier industries like steel, plastics, aluminum, rubber, and metal fabricating. In 1984, employment in the auto industry averaged an estimated 123,900. Through the first five months of 1985, auto industry employment has averaged an all-time high of 127,600 workers.

Given the industry's critical role in job creation and preservation, a major question emerging from our analysis is how many people the industry will be able to employ in the future. That question has no easy answer. It depends on both the future scope of automotive manufacturing in Canada and on the number of jobs that will disappear because of productivity gains.

Up to now the industry has been able to expand employment even while registering regular increases in productivity. This was made possible by steadily expanding output in real terms. As the industry faces a future of slower growth and higher levels of imports, it will be difficult, if not impossible, even to maintain employment levels. The employment paradox will be that just to maintain output in the face of the new competitive challenge, the industry will need to raise productivity substantially. But raising productivity means that

fewer jobs will be required for a given level of output. So even if the industry narrows the cost advantage enjoyed by Japanese manufacturers, it will be hard pressed to maintain current employment levels. The only way to do both would be to find new export markets. The Task Force believes, however, that major steps in that direction, other than more exports to the U.S., will be difficult, because there are few opportunities and many countries chasing them.

In this chapter, we set out employment projections to 1990 to accompany the three industry scenarios we explored in Chapter 2. Using these employment projections, we identify the labour adjustment issues raised by each scenario. Finally, we discuss what steps could be taken to improve the labour adjustment process if significant employment dislocations should occur.

EMPLOYMENT OUTLOOK

To translate our three scenarios for the size of the Canadian industry into employment scenarios, it is necessary to factor in a rate of labour productivity growth in each scenario. In the first and second scenarios we have assumed a labour productivity growth rate of 4% per year to 1990. A 4% growth rate means that each year only 96% of the hours of labour used in the previous year would be needed to produce the same level of real output[1]. Based on our interviews with companies and with industry experts and the Task Force survey of the parts industry, a 4% average growth rate seems reasonable if the industry is performing well -- which is assumed in the first two scenarios.

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1. Though actual productivity gains should be calculated on the basis of total hours worked in the industry, we have simplified our calculations in this chapter by applying the growth rates in labour productivity to the total number of workers and not to the hours worked.

In the third scenario, the Import Flood Scenario, we assume only a 2% growth rate in labour productivity to 1990. If the Canadian industry performs less well than the U.S. industry, and if overall sales are shrinking because of sharply higher imports of vehicles and parts (as assumed in the third scenario), then a lower productivity growth rate is appropriate. Indeed, it could become very difficult to expand productivity by even 2% a year if imports were increasing dramatically in a market growing slowly. The 2% a year figure under Scenario 3 might more likely represent an average of extremes, with some firms achieving healthy productivity gains of 4% or more while others falter and record no gains -- or even declines -- as their capacity utilization falls.

Table 8.1

Major Assumptions* Underlying Three Employment Scenarios For the Canadian Auto Industry in 1990

	1984 Actual	Scenario 1: Universal Auto Pact	Scenario 2: More of the Same	Scenario 3: Import Flood
Total Canadian Automotive Shipments**	$32.7 billion	$47.4 billion	$37.6 billion	$25.3 billion
Average Annual Growth Rate of Shipments	N/A	+6.4%	+2.4%	-4.2%
Annual Labour Productivity Growth Rate	N/A	4%	4%	2%

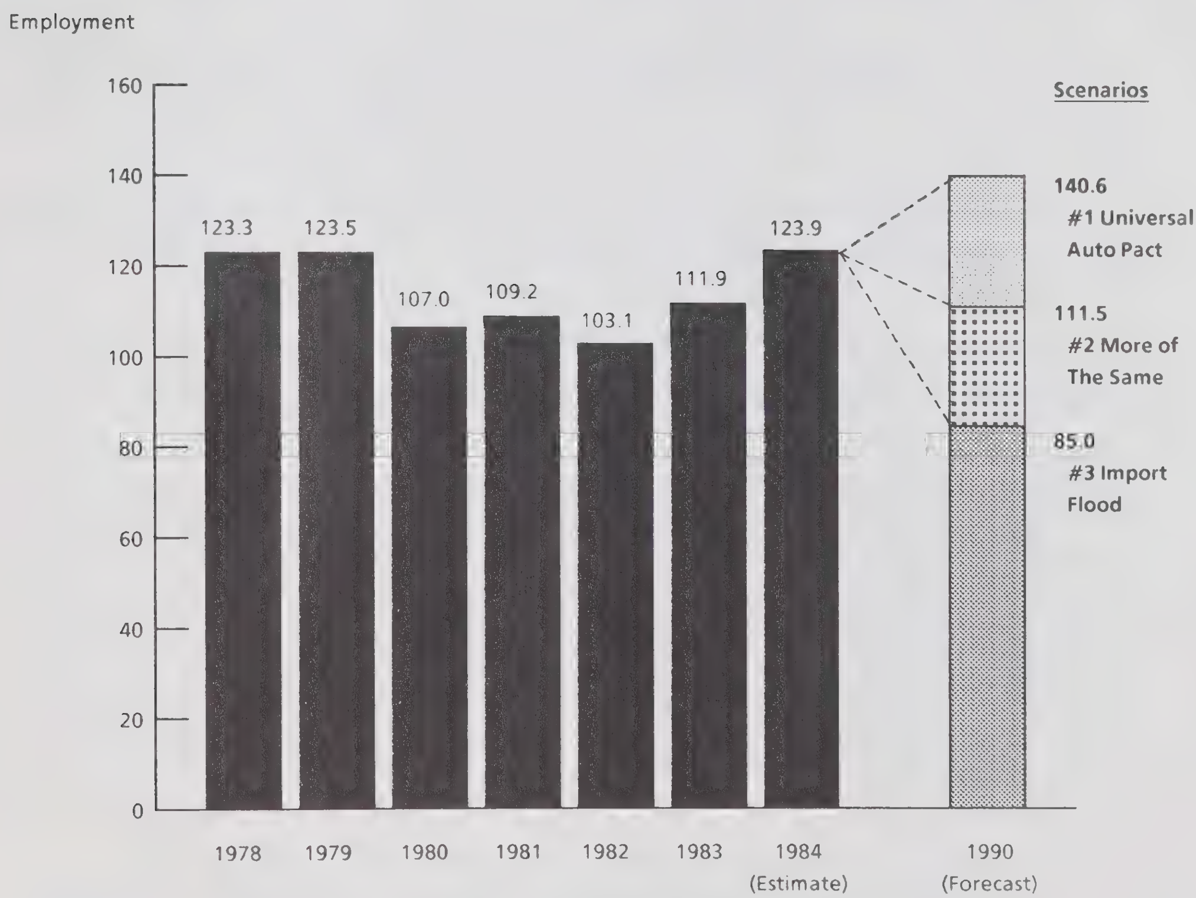
* See Chapter 2 for a description of how each of the three output scenarios was derived and what other assumptions were made about trade policy, vehicle and parts imports, and Canada's share of North American production.

** All in constant 1984 dollars.

The employment levels anticipated in each of the three scenarios are, as one would expect, quite different. In Scenario 1, the Universal Auto Pact, automotive employment would rise by 13.5% to 140,600 in 1990 (see Figure 8.1).

Figure 8.1

Three Scenarios For Employment In The Canadian Auto Industry in 1990 (Thousands of Workers)



* In 1983 Statistics Canada began including SIC 3256, Plastic components, and a few otherwise classified firms in SIC 325. Our 1983 and 1984 numbers do not include SIC 3256 and the other firms added to SIC 325 in 1983. Actual reported employment in 1983 with SIC 3256 and adjustments included was 118,200. In 1982 it would have been 108,000 if similarly adjusted.

Sources: Statistics Canada for 1978-1984 (SIC 323, 3241, 3243, 325, 188), The Canada Consulting Group Automotive Industry Model for 1990 Scenarios.

This would occur despite the fact that productivity gains would have reduced the labour required for a given level of output to 78% ($.96^6$) of 1984 levels.

Scenario 2, More of the Same, anticipates a 10% decline in employment by 1990, to 111,500 workers in the auto industry. Despite 2.4% annual growth in real output in Scenario 2, employment falls because the annual growth in labour productivity, at 4%, is greater. Under Scenario 2, the level of employment in 1990 would be roughly as high as in 1983.

Scenario 3, Import Flood, projects a major decline in employment of 31% -- to 85,000 workers in 1990. Productivity gains would play a very minor role in these employment losses. Sharply higher vehicle and parts imports and lower Canadian production relative to the U.S. would account for almost three-quarters of the jobs lost in the industry under Scenario 3.

Scenarios 2 and 3 make no allowance for non-Auto Pact investment being of lower quality with respect to value-added contribution to the economy than existing Auto-Pact investment. Were this investment to be of lower quality, resulting in only the assembly of imported parts and components at Canadian assembly platforms, the Scenario 2 and 3 employment projections would have to be lowered by as much as 5,600 jobs.[2] Further, as noted in Chapter 5, assembly platform investment would employ lower skilled labour. Pure assembly plants have very low requirements for skilled tradesmen, metal workers and technicians, employing almost exclusively lower paid unskilled and semi-skilled workers.

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2. New offshore manufacturer vehicle assembly in Canada is expected to total 280,000 passenger cars annually by 1990. Assuming, (i) 27.8 person-hours per vehicle assembled, (ii) 1,840 person-hours per worker per year, and (iii) using the Statistics Canada input-output model, 1.136 parts industry jobs for each assembly industry job, the offshore manufacturer vehicle assembly could result in a loss of 4,230 assembly industry jobs and 4,805 parts industry jobs for a total of 9,035 jobs lost. However the offshore manufacturing investment is expected to yield 3,400 jobs in total, bringing the net job loss to 5,635. To the extent that offshore manufacturers source parts and components in Canada, and to the extent that offshore manufacturer vehicle assembly in Canada does not displace North American vehicle assembly in Canada,these additional jobs loss levels would be reduced.

LABOUR ADJUSTMENT PROSPECTS

Our three scenarios yield very different levels of future employment in the Canadian auto industry. Over 55,000 jobs separate Scenario 1 from Scenario 3. Although such a range makes labour market planning difficult, it accurately reflects the tremendous uncertainty surrounding the size of the industry in the future. Scenarios 1 and 3 may be somewhat less probable than Scenario 2, but from a labour market planning perspective, all contingencies need to be taken into consideration. We will examine in turn the labour force adjustments that would be likely under each scenario.

Despite the significant increase in direct automotive employment under Scenario 1, there would probably be some labour dislocation. As offshore producers invested in Canada, they could gain market share from existing domestic producers, resulting in plant closings. The trade policy in Scenario 1 would assure a level of value-added in Canadian production equal to at least 60% of the total value of sales in Canada -- so overall employment levels would not be threatened by changes in relative market share. But who exactly was employed in the industry could change as some companies grew and others shrank in the turmoil of competition. There is no scenario offering the comfort of little adjustment. Competition in the automotive environment over the next five years will be so intense that many firms are likely to lose even if the Canadian industry as a whole gains. Nevertheless, those thrown out of work by company bankruptcies in the expanding automotive job market of Scenario 1 may be able to get new jobs if they are willing to move.

Scenario 2 presents a more difficult employment outlook. Overall employment will decline by 10% by 1990 or 1.6% a year. If these displaced workers left the industry at a regular rate and departed from all companies at the same speed, natural attrition in the workforce could accommodate this decline easily. Natural attrition is defined as all quits, retirees, or deaths among the

workforce except for seasonally employed persons. The annual natural attrition rate in the independent parts industry is currently 4.5%[3] based on our survey of the automotive parts industry. Among the major vehicle companies the natural attrition rate is in the range of 6% to 8%. Thus, in both the vehicle and the independent parts sides of the industry, natural attrition is well above the rate at which jobs would be lost. If the jobs disappeared evenly over time, layoffs could be avoided. Departing workers might simply not be replaced.

Undoubtedly, in many companies this is exactly how the job loss would be handled. But inevitably, not all companies will experience the job loss evenly. Some plants will close, and their entire workforces will lose their jobs. Others will lose contracts to imports and see their workforces cut by a third or a half. Thus, even in a scenario of slow overall job loss, some labour adjustments will be necessary. Unlike the situation in Scenario 1, however, those losing their jobs under Scenario 2 will not find it quite so easy to be rehired when the workforce is contracting by 1.6% every year.

In Scenario 3 massive labour dislocations would occur. The overall workforce would be shrinking by 6% a year as 38,900 jobs were lost in the industry. This rate would be at or above many company attrition rates, meaning that unless job losses were spread perfectly across companies, many people would be thrown out of work. Indeed, such major dislocations would be inevitable. Sharply rising imports of vehicles and parts would force the closure of many plants. Whole communities dependent on the industry would be depressed. Those thrown out of work would have little chance of being rehired elsewhere, given the extent of employment shrinkage across the industry.

The projected employment level in Scenario 3 -- 85,000 jobs -- would be 82% of the level of employment in 1982 at the bottom of the industry recession. The economic pain and social costs of such a major loss of jobs would be tremendous. In addition to direct employment losses in the auto industry, up to 44,000 additional jobs would be lost in industries like steel that supply the

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3. This represents a weighted average attrition rate for the entire independent parts industry workforce.

automotive industry.[4] The costs to the individual workers who lose their jobs and the overall adjustment problems associated with such a grim scenario are the subject of the next section.

THE COSTS OF LABOUR DISLOCATION

As we have seen, some labour dislocation in the automotive industry is inevitable by 1990. Under Scenario 3, large numbers of auto workers would lose their jobs, and the adjustment required would be enormous. Under Scenario 2 some dislocations in the workforce would be likely as overall employment in the industry slowly declined and competition in the industry put some companies out of business. Under Scenario 1, a few auto workers would lose their jobs as a result of competitive shifts, although most would be able to find new ones fairly easily in an expanding automotive employment market.

Clearly, from a public policy point of view it is the labour dislocations possible in Scenarios 2 and 3 that demand closer study. In both scenarios some workers would lose their jobs and find re-employment difficult. To understand what the personal and societal costs of such dislocations might be, the Canada Employment and Immigration Commission carried out for the Task Force a study of the actual unemployment experience of laid-off auto workers during the industry recession of 1981-82 and a parallel study of the earnings experience of all workers who left the industry in the 1972-1983 period. Both CEIC studies were based on the automotive industry labour force data base described in Chapter 7.

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4. Based on the employment multiplier used in Statistics Canada 1978 national input/output open model for direct suppliers to the automotive industry (SIC 323 and 325).

Projecting The Number Of Layoffs

The first cost of labour dislocation to be considered is how many auto workers might actually lose their jobs. Scenario 2 assumes 12,400 jobs would disappear by 1990. It is difficult to estimate how many of those disappearing jobs could be accommodated through attrition without layoffs. About 69% of the Scenario 2 job loss would be due to higher productivity in the industry and 31% to higher import levels of vehicles and parts (see Table 8.2). Based on our industry interviews, most companies expect to be able to accommodate productivity gains without having to layoff employees. (Notable exceptions are those cases where productivity gains make possible the consolidation of separate plants.) In fact 10% of the companies in our automotive parts survey said they had an explicit policy of not replacing employees lost through normal attrition. Such policies do not guarantee no layoffs because of productivity gains, but they indicate a commitment to attain such gains without layoffs if possible.

Given these facts and the attrition rate of 4.5% to 6% prevailing in the industry, we assume that 80% of all productivity gains in Scenario 2 could be accommodated, without layoffs through natural attrition. Thus, productivity gains might result in 1,700 workers (20% of 8,600) actually losing their jobs. We also assume that all of the roughly 3,800 jobs because of higher imports would result in layoffs because import gains will come mainly at the expense of dedicated production capacity for specific product lines, which will be shut down if not utilized. This may be an overstatement, but we expect that import losses will be difficult to accommodate through attrition under any scenario.

In summary, we believe that at most 5,500 workers under Scenario 2 might face permanent layoff because of long-term structural changes in the industry by 1990. It must be remembered that we have not considered cyclical factors in our analysis. In addition to these 5,500 workers, many other permanent job losses are possible as a result of cyclical conditions in the industry. Despite the industry's employment resurgence in 1983-84, some auto workers laid off in the cyclical downturn of 1981-82 did not find re-employment in the industry.

Estimating how many auto workers will actually lose their jobs under Scenario 3 is equally problematic. The total workforce under Scenario 3 would drop by 38,900 by 1990. We estimate that 72% of this decline would be attributed to imports and lower Canadian production relative to U.S. production, and about 28% to productivity gains. If we assume that all of the jobs displaced by imports and lower Canadian production resulted in actual layoffs and 20% of the jobs displaced by productivity gains resulted in such losses (as we assumed above), then the total number of workers suffering permanent layoff under Scenario 3 would be about 30,200. Again, this does not include any workers laid off because of cyclical downturns in the industry. We are projecting layoffs based only on structural shifts in the size of the industry and assuming that the value-added contribution to the economy of new investment is comparable to that of existing investment

Table 8.2

Permanent Layoffs Likely Under Scenarios 2 and 3

	Scenario 2: More of the Same	Scenario 3: Import Flood
1. Total Jobs Lost	12,400	38,900
2. Jobs Lost Because of Imports	3,800 (31%)	21,600 (56%)
3. Jobs Lost as Result of Declining Canadian Production Relative to U.S.	0	6,400 (16%)
4. Jobs Lost Because of Productivity Gains	8,600 (69%)	10,900 (28%)
5. Layoffs Likely from Productivity Gains	1,700 (20% of 8,600)	2,200 (20% of 10,900)
6. Total Permanent Layoffs Due to 2, 3, and 5 Above	5,500	30,200

Source: Calculations based on The Canada Consulting Group Automotive Industry Model. See also Chapter 2.

The Duration of Unemployment

The 5,500 workers who might lose their jobs under Scenario 2 would have a difficult but not impossible time finding new jobs in the auto industry. Most of the 30,200 workers who might lose their jobs under Scenario 3 could not expect to work in the industry again. Based on the historical experience of displaced workers in the auto industry, most of them would be unlikely to find new work quickly.

Table 8.3
Average Duration of Unemployment for Workers Separated from the Automotive Industry 1972-1983

	Canada	Quebec	Ontario
All Laid-off Auto Workers			
Male	8 weeks	9 weeks	8 weeks
Female	16 weeks	18 weeks	14 weeks
Total	9 weeks	10 weeks	9 weeks
Permanently Separated Auto Workers			
Male	24 weeks	28 weeks	24 weeks
Female	33 weeks	38 weeks	33 weeks
Total	27 weeks	30 weeks	27 weeks

Source: CEIC Automotive Labour Adjustment Study.

The CEIC Automotive Labour Adjustment Study undertaken for the Task Force found that between 1972 and 1983 the average duration of unemployment for all auto workers who left the industry permanently was 27 weeks. This compares with an average duration of unemployment for all auto workers (both those who are rehired and those who are not) of 9 weeks per unemployment spell. Women who left the industry permanently, remained unemployed for an average of 33 weeks, as compared to 24 weeks for men. Workers in Quebec who left the industry permanently were unemployed an average of 30 weeks, while workers in Ontario faced an average of 27 weeks of unemployment.

All of these averages understate the true discomfort likely to be experienced by unemployed auto workers in Scenario 3. In the first place they are averages for the period 1972-1983, which included years of healthy economic growth as well as occasional recessions. Under Scenario 3 the automotive industry would be declining so precipitously as to make it very difficult for auto workers to find work in related industries. Secondly, in these statistics, duration of unemployment refers to how long permanently separated workers went before taking new employment of any kind. Many of the jobs that ended their unemployment spells were in retailing or other low-paid service sectors. Thus, the average duration of unemployment understates the actual time that passed before the workers secured comparable full-time employment.

A recent U.S. study of Michigan auto workers laid off by GM, Ford and Chrysler in 1979-1982 found that of the 30% who were not recalled to the auto makers by mid-1984, only half had found new full-time jobs.[5] Of the half still unemployed in 1984, one in five had stopped looking for employment. Many of

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5. See "The Unemployment and Re-employment Experiences of Michigan Auto Workers" by Avery Gordon, Paul Scherrish, and Barry Bluestone, December 1984.

the others had taken part-time employment until they could find full-time jobs or until recalled, if that ever comes. Those who took on part-time work were on layoff an average of two years. The downturn in the U.S. auto industry was more severe than in Canada, and U.S. employment levels in 1984 were still 100,000 below the 1978 peak of 1,189,900. This and the part-time job factor discussed above account for the more severe unemployment pattern in the U.S. study. However, in the serious employment decline forecast under Scenario 3, a more severe outlook would be likely, with unemployment spells of up to a year probable.

It is important to note that given the industry's seniority rules, the burden of any long-term layoffs under Scenario 3 would fall most heavily on younger workers and women who tend to have less seniority. The CEIC study analyzed in more depth those auto workers who became unemployed in the 1981-82 automotive recession. It found that an estimated total of 2,612 auto workers were unemployed for 26 weeks or more after layoff in 1981-82. This was equal to 2.4% of total automotive employment in 1981. Of these 2,612 workers, 560 or, 21%, were still unemployed after 51 weeks.

The auto workers laid off for 26 weeks or more included a higher proportion of females (34%) and younger workers (41% under 30 years old) than the group of auto workers who were laid off for less than five weeks. Only 18% of the latter group were female and only 27% were under 30 years old. Under Scenario 3, the hardest hit of the 30,200 workers likely to lose their jobs would be women and young people, just as was the case in the 1981-82 downturn.

Table 8.4

Age and Sex Distribution of Random Sample of Unemployed Auto Workers in 1981-82

	All Unemployed Auto Workers in Sample	Auto Workers Unemployed Less Than 5 Weeks	Auto workers Unemployed 26 Weeks or More
Total	10,677*	3,830	2,612
By Sex:			
Male	73%	82%	66%
Female	27%	18%	34%
By Age:			
Younger Than 30 Years	37%	27%	41%
30-39 Years	28%	35%	24%
40-49 Years	19%	23%	17%
50 Years or Older	16%	16%	17%

* This number of unemployed workers is from a CEIC random sample of all employed auto workers. It is not the actual number of unemployed auto workers in 1981-82.

Source: CEIC Automotive Labour Adjustment Study.

The Loss In Earnings

Even when the displaced workers of Scenario 3 do find jobs, they will continue to suffer a relative loss in earnings compared to the days of their automotive employment. Most of the displaced workers will find jobs in lower paying industries. As we saw in Chapter 7, the majority will find new employment in service sectors like retail trade, which pay significantly less than the automotive industry.

The CEIC study analyzed the gross weekly wages of workers before and after permanent separation from the auto industry in 1972-1983. The overall industry average wage in constant 1981 dollars over the period 1972-1983 was $473. After leaving the auto industry, the separated worker typically made only 66% of the average wage in the industry. In Ontario the wage loss was slightly more significant than in Quebec although the average non-auto wage was higher.

Table 8.5
Gross Weekly Wage of Auto Workers Before and After Separation from Industry 1972-83
(Constant 1981 $)

	All Canada	Ontario	Quebec
1. Average of All Auto Workers	$473	$472	$480
2. Separated Auto Worker Before Separation	$363	$374	$334
3. Separated Auto Worker After Re-employment In Non-auto Job	$240	$232	$254
4. New Non-auto Wage as % of Average Auto Wage (3/2)	66%	62%	76%

Source: CEIC Automotive Adjustment Study.

Based on this historical experience, the 30,200 auto workers who would lose their jobs under Scenario 3 would find themselves suffering a major loss of personal income, even after they become re-employed. When we add in the costs associated with unemployment, there would be a substantial loss to society as a whole in the form of higher unemployment insurance payments, greater welfare costs in some instances, and lower tax revenues even when the individual became re-employed. In short, the costs of the labour dislocation under Scenario 3 could be mammoth at the level of both the individual and society generally.

APPENDICES

APPENDIX 1

TASK FORCE CONSULTATIONS

In addition to the 19 private meetings held with industry observers and participants during the course of Task Force consultations, the Task Force or co-chairmen met 12 times to receive presentations from individuals and organizations, to review the progress of the Task Force, or to discuss the Task Force's final report as follows:

Toronto

January 18, 1985

Task Force Opening Sessions

February 28 - March 1, 1985

Presentations:

Using New Manufacturing Technologies: The Human Resource Issues
Mr. John Paul McDuffie, Harvard

The Canadian Automotive Industry: A Global Perspective
Mr. Martin Anderson, Boston

Windsor/Michigan

March 26-27, 1985

Tours:

Chrysler Pillette Road truck plant, Windsor
Chrysler mini-van plant, Windsor
Pontiac Fiero plant, Pontiac, Michigan

Presentations:

The Joint Ford/UAW Training Centre: Adjusting to Adjustment
Presentations by Training Centre Staff

Robotics in the United States Automotive Industry
Mr. Timothy Hunt, Upjohn Institute

Ottawa

May 22, 1985

Interim Report: Review of Findings To Date

May 23, 1985

Meeting with the Hon. Flora MacDonald, Minister of Employment & Immigration

Toronto

June 19, 1985

Presentations:

The Pontiac Fiero Experience with Worker Involvement
Presented jointly by Fiero management and labour representatives

Worker Involvement: A Review of Results To Date
Prof. Harry Katz, MIT

Montreal

July 16, 1985

Presentations:

Labour Mobility and Adjustment in the Canadian Automotive Industry
Mr. Gary Fletcher, Employment and Immigration Canada

Labour Mobility and Adjustment: the United States Automotive Industry Experience
Prof. Barry Bluestone, Boston College

The Implications of Technological Change on Skill Levels
Prof. Harley Shaiken, MIT

Preliminary Results of the Independent Automotive Parts Manufacturers Survey
The Canada Consulting Group

Toronto

July 25, 1985

Meeting with the Technology Committee of the United Auto Workers - Canada

August 12, 1985

Meeting with the Hon. Gregory Sorbara, Minister of Skills Development, Ontario

Review of Findings to Date and draft chapters of report

September 11, 1985

Review of Findings to Date and draft chapters of report

Quebec City

October 3, 1985

Meeting with the Ministries of Industry, Commerce & Tourism and of Manpower & Social Security

Toronto

October 16, 1985

Meeting with members of the Automotive Industries Association

November 20, 1985

Meeting with the Automotive Parts Manufacturers' Association - Human Resource Committee

November 28, 1985

Final Report

The research work of the Task Force included:

1. Case studies undertaken on the human resource experiences of seven companies

   Ford Canada - Windsor/Essex engine plants
   General Motors Canada - Ste. Thérèse assembly plant
   General Motors Canada - Windsor transmission plant
   Waterville Cellular - Waterville, Quebec
   Monroe Shocks - Owen Sound, Ontario
   Amcan Castings - Hamilton, Ontario
   TRW - Stoney Creek/Brantford, Ontario

2. Meetings with the following companies to discuss their human resource experiences:

   American Motors Canada - Brampton
   Camoplast - Kingsbury, Quebec
   Chrysler Canada - Windsor
   Dominion Automotive - Toronto/Uxbridge, Ontario
   Ford Canada - Oakville
   General Motors Canada - Oshawa
   Heatex Howden - Rexdale, Ontario
   Mack Canada - Oakville

APPENDIX 2

TASK FORCE SURVEY OF THE INDEPENDENT AUTOMOTIVE PARTS INDUSTRY

The Automotive Parts Manufacturers Association (APMA) conducted for the Task Force a survey of all firms in Canada believed to be manufacturers of automotive parts. The content and methodology of the survey was as follows:

Survey Title: The Human Resource Implications of Technological Change

Content: Identifying Technological Trends and Workforce Requirements

- current technologies being used
- change in technologies anticipated to 1990
- profile of the current workforce, by occupation
- change in profile anticipated to 1990

Assessing the Workforce Implications of Technological Trends

- recruiting implications
- skills, education and training implications
- human resource planning implications

Company Profile

- processes and products
- company size, by number of employees and volume of sales
- workforce demographics (age and gender breakdowns)

Methodology:

Sample Identification: A master list of automotive parts manufacturers was prepared by the APMA. This list was a compilation of the membership of the APMA, the membership of the Automotive Industries Association and other companies identified by various sources as being possible suppliers to the automotive industry. (These latter companies were

more speculative additions to the list as part of a full effort to canvass the industry as widely as possible.)

Questionnaire Design and Testing: The questionnaire design was led by the APMA and included the full expertise internal to the Task Force and the advice of industry officials. Each draft was in addition tested on firms within the industry for relevance and accuracy: in all, six pre-test field interviews were conducted with firms in both Ontario and Quebec.

Distribution and Followup: The 1,022 surveys were mailed during the week of May 21, 1985. Approximately half of the recipients received at least one followup telephone call to encourage them to participate.

Returns: As a result of these followup calls it became apparent that there was some duplication in the lists and that several hundred recipients were probably not manufacturers of finished automotive parts. In all, 190 questionnaires were returned of which 170 were determined to be actual automotive parts manufacturers. This number of responses constitutes about 40% of the 400 firms which comprise the main body of the automotive parts industry. However, the 170 firms reported a total of 52,000 employees which by any definition is most of those employed in the independent parts industry. The automotive sales reported by the respondents exceeded $4.4 billion.

Participant Interviews: 105 of the 170 respondent companies received telephone calls or, in certain cases, actual visits from Task Force staff in order to clarify results and learn more about company experiences. These participant interviews were invaluable in ensuring there was a common understanding of the survey questions across all participants as well as providing a vast number of 'mini'-case studies on technological change and the human resource implications of that change.

Tabulation and Analysis of Returns: Tabulation of the results took place during the month of July, and preliminary results were presented to a meeting of the Steering Committee in Montreal on July 16, 1985

Additional Assistance: The Task Force would like to thank the Ontario Ministry of Skills Development for its assistance and support of the APMA survey.

APPENDIX 3

THE CANADA CONSULTING AUTOMOTIVE INDUSTRY MODEL

To derive the three scenarios for the future size of the Canadian automotive industry discussed in Chapter 2 and their employment levels discussed in Chapter 8, it was necessary to construct an economic model of the industry. The Canada Consulting Group developed such a model using six critical variables:

- The overall level of vehicle sales in Canada and the U.S.
- The level of real parts shipments in Canada and the U.S.
- The overall level of real automotive shipments in Canada and the U.S. - both vehicle and parts
- The level of vehicle imports in Canada and the U.S.
- The level of parts imports in North America
- The level of Canadian value-added as a proportion of total North American value-added in the industry.

Data were analyzed for the years 1978-1983 and a model was constructed to test the sensitivity of changes in any one of the variables on the others.

Several simple statistical relationships were identified which were then used to construct the three scenarios for 1990. These relationships were found to be remarkably constant over the six years of data. In simple form the three most important include the following. When all other factors are held constant:

- Each 1% increase in the market share of vehicle imports in North America would result in a 1.2% decline total real Canadian automotive output

- Each 1% of North American market share gained by parts imports would result in a ½% decline in total real Canadian automotive output
- Each 1% increase in Canada's share of total North American value-added in automotive production would result in a 14% increase in total real Canadian automotive output.

The scenario results derived from the model were compared to the output of several other major economic forecasting models for the North American automotive industry, and our estimates of the relationships between major variables were entirely consistent with the relationships underlying these future industry scenarios although assumptions about actual import levels varied widely.

The three employment scenarios in Chapter 8 were derived by translating the projected change in overall Canadian automotive shipments in each scenario directly into a percentage change in employment and then factoring in a labour productivity growth rate (see Table 8.1). While vehicle and product mix changes can affect overall labour intensity, it made little sense to make assumptions about the direction of such product mix factors. As with the general industry scenarios, the employment scenarios were tested against other industry models and found generally consistent although assumptions in other models varied widely on the question of import levels.

APPENDIX 4

Members of the Task Force Steering Committee & Working Group.

Co-chairmen

Mr. Maurice C. Fertey
President
American Motors
(Canada) Inc.

Mr. Patrick J. Lavelle
President
Automotive Parts
Manufacturers' Assn.
of Canada

Mr. Robert White
President
United Automotive
Workers Canada

Employment & Immigration Canada

Mr. Barry Carin

Mr. Derwyn Sangster

Mr. Gary Fletcher

Mr. Robert Somers

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Ministry of Skills Development

Dr. Benson Wilson

Mr. Frank Whittingham

Mr. Barry Rose

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Mme Michèle Jean

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Mr. Dennis DesRosiers

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Mr. Norman Clark

Mr. Brian Hickey

Automotive Industries Association

Mr. Dean Wilson

United Automotive Workers Canada

Mr. Sam Gindin

Mr. Buzz Hargrove

American Motors (Canada)

Mr. John Gardner

Chrysler of Canada

Mr. Bill Fisher
Mr. Jim Dunn

Ford of Canada

Mr. Art Hanlon
Mr. Peter McBain

General Motors of Canada

Mr. Rick Curd
Mr. Norm Stewart